MENTAL SCIENCE SERIES.

A MANUAL

OF

DEDUCTIVE LOGIC

FOR

STUDENTS PREPARING

FOR THE

F. A. AND B. A. EXAMINATIONS

OF THE

INDIAN UNIVERSITIES.

BY

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ERRETA.

TO

H. H. Maharaja Rajendra Singh, &c., &c.

OF PATIALA.

THIS WORK IS RESPECTFULLY DEDICATED,

As an humble tribute of admiration for his
interest in all literary movements,
and kind feelings towards
all men of letters,

BY

His Highness's most obliged and obedient servant,

M. N. CHATTERJEE.

PREFACE.

The present treatise is intended for students preparing for the University First Examination in Arts. Without overburdening their memory, to give them the necessary principles, a taste for higher study, and to enable them to gain fair marks in their examination have been the author's object.

The author's thanks are due to the Revd. W. Robb, M. A., for the trouble he took occasionally in correcting proof sheets of the first edition.

It is more from necessity than from any other consideration that the second edition of the Manual of Deductive Logic is offered to the public. The author's experience as a Professor of Logic for the last few years led him to make some valuable additions to the contents of the book, and some alterations in the body of it. Since the date of publication of the first edition of the *Manual* many applications have been received from candidates of almost all the Universities of India in which it has invariably been stated that students, not having the advantages of attending lectures in Colleges, or belonging to Colleges in which lectures may not be efficient enough, have already found a great help in the compendium.

The author has the pleasure to state here that he has noticed youngmen not learning Deductive Logic beforehand, have, from their study of the *Manual* for a mouth or two, passed the Intermediate or F.A. Examination successfully.

The present edition contains many principles and explanations, which beginners of the science are not expected to find within their easy reach.

His Highness, Maharaja Rajendra Singh, &c., &c., has been gracious enough to patronise this publication. Had it not been for the munificence and great literary taste of His Highness, this edition would, probably, have been long delayed.

PATIALA, *January* 1892.

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INTRODUCTORY CHAPTER.

Section I.

On Definition and Parts of Logic.

Dr. Ueberweg defines 'Logic' as 'the science of the regulative laws of human knowledge.' The definition is, according to British logicians, too comprehensive. Knowledge can be intuitive as well as inferential; and, therefore, logic from Ueberweg's definition would concern itself with knowledge, intuitive and inferential both. But as British logicians do not recognise the former sort of knowledge as entering at all into the subject of Logic, they consider the definition too extensive. To make the definition unerroneous we may substitute 'thought' for 'human knowledge,' and define Logic as the regulative laws of thought.

With all the differences of principles and opinions noticed among philosophers, and similarly among logicians, we can classify them under the three distinct heads. Logic may be defined for each of these classes, and again for them all.

Logic, as the science of the conditions and laws
Logicians advocating the subjective system of philosophy define to which the results of comparison must conform to be conclusive and unerroneous.

Logic, as the science furnishing us with the most
general relations, and correlations of individuals, and

Logicians advocating the objective system of philosophy define

attributes. The province of Logic, as held by this class, is to justify the relations of individuals and attributes arrived at by comparison, and the relations from one or more given relations. *

Logic as the science furnishing us with rules for the proper application of names propositions, and arguments.

Logicians advocating the prime importance of language define

The above definitions clearly show what relations Logic bears to other sciences.

That it is a branch of the mental sciences and subordinate only to psychology is evident from the *first definition*, and hence it has to treat of conception, judgment, and reasoning.

That it is the principal branch of the objective sciences, and a science of the regulative principles, of all phenomena, material or mental, are evident from *the second definition*, and hence it has to treat of the most general relations, sub-relations, and aspects of things.

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* "Some of the reviewers of the *Manual* considered this passage too difficult for an F. A. student, and, therefore, the book itself. They seem, however, to have lost sight of the fact, that a very simple definition of Logic from the objective point of view is almost impossible just as definition of a concept from the same point of view is impossible without its resembling a Hegelian one. I do not think, that a student, who has already learnt the general definition, will find difficulty in grasping this one.

That it is independent of all other sciences bearing a certain relation to philology only, and having its ends subserved by grammar and language, is evident from *the third definition*. It cannot have to deal with anything else than with names, propositions and arguments.

A general definition, that may be held good from the points of views of all the logicians, has been given at the beginning of the chapter. 'Thought' substituted for 'human knowledge' in the body of Ueberweg's definition gives the definition required.

Thought, the subject-matter of logicians, can be used in the three different senses :

(1.)—Any mental phenomena of cognition, emotion or volition.

(2.)—Any process or product of cognition, *viz.* of perception, memory, imagination, &c.

(3.)—The process and product of comparison. When process, it stands for conception, judgment and reasoning ; when product, for concept, judgment and reasoning. According to the particular definitions, and to the general one of Logic concepts, judgments, and reasoning can be used in the various senses.

A concept, as a thought, an idea, or a notion,

The first class of logicians define

having attributes, or group of attributes common to number of individuals to agree with.

A judgment, as a thought, being the mental determining of a relation of two concepts or notions either in the affirmative or in the negative.

A reasoning, as the determining of a relation between two or more judgments, or of relation of two concepts by means of a third.

A concept, as an attribute, or groups of attributes common to a number of individuals.

The second class logicians define

A judgment, as a relation between two attributes, two individuals, or an individual and an attribute.

A reasoning, as the determining of a relation between two individuals or attributes by means of a third, or the establishment of a relation of two individuals or attributes from one or more of such given relations.

A concept, as a sign of the result of conception and therefore to be expressed by a word or combination of words.

The third class of logicians define

A judgment, as an expression in language of a relation between two concepts; or an affirming or denying of one term of another.

A reasoning, as an argument consisting of a series of propositions standing in relation of in-

terdependence, or the inference of a relation of two terms by means of a third.

Illustration of a concept, a judgment, and a reasoning from the definitions of the different views given above. Of the first class :—

' Triangle' is an idea agreeing with the attribute common to all individual triangles under the class.

" Man is mortal." The two concepts " Man " and " Mortal " of the judgment have their relation determined here.

' Men of systematic thought ' are philosophers ; Spencer is a man of systematic thought ; therefore " Spencer is a philosopher." A relation between the concepts, philosopher and Spencer is established here by means of a third, viz., ' men of systematic thought.'

Of the second class :—

'Triangle,' a concept meaning an aggregate of attributes common to all triangles.

In the example of judgment given above, the relation here is between the attribute " mortality " and the group of attributes implied by " man."

In the example of reasoning given above, the relation here between the attributes implied by ' Philosophers,' and ' Spencer,' is established by a third, viz., ' men of systematic thought ;' there

are instances under this head where relations can be seen to be established between two things or attributes, by means of a third ; as in ' All men are fallible,' ' Popes are men,' therefore ' Popes are fallible.'

Of the third class :—

' Man,' a concept, nothing more than a mere name of the whole class of human beings. ' Man is mortal' as a judgment, is a mere expression in language, of the relation between the concepts ' Man ' and ' Mortal.'

Any of the examples of reasoning given above, can, when expressed in language, be a mere argument.

The first view has been said to be held by philosophers, advocating the subjective system. Hamilton belongs to this class. He defines Logic as ' the science of the laws of thought,' ' the science of the formal laws of thought,' ' or the science of the laws of the forms of thought ; ' from these we can summarise his definitions by saying, that it is the science of the principles for the regulation of thoughts. To be logically true, every thought must be free from inconsistency and self-contradiction.

The fundamental principles of consistency will be enumerated and explained towards the close

of the chapter. That Hamilton differs from the other logicians is to be noticed in the fact of his conforming merely to the regulative principles of thought, and in excluding entirely the object of thought.

In his *System of Logic* John Stewart Mill defines Logic as "the science of the operations of the understanding which are subservient to the estimation of evidence : both the process itself of advancing from known truths to unknown, and all other intellectual operations in so far as auxiliary to this." The definition is, indeed, a comprehensive one.

From the light of this definition the duty of a logician turns out to be (1) ' to attempt a correct analysis of the intellectual process ' ; and (2) ' to name a set of rules or canons for testing the sufficiency of a given evidence to prove any given proposition.'

Mill in his *System of Logic* seems to differ from his views as seen in his *Examination of Hamilton's Philosophy.*

With all the seeming self-contradictoriness of his opinion, he must ever be considered as *one among the material logicians.* He defines Logic 'as the art of correct thinking, and science of the conditions of

correct thinking,' in other words, 'the science of the conditions on which right concepts, judgments and reasonings depend.') In his 'Examination of Hamilton's Philosophy,' Mill expounds the first theory, grounding the whole system on the condition, that the product of thought must not only be free from self-contradiction, but must also correspond with the object, of which it is an idea. In the 'System of Logic' he uses the phraseology of the third class, and verifies the real import or meaning of his names, propositions, and arguments in every case, by reference to the second.

The chief. among the Scientific Realists is *Herbert Spencer*. His definition of Logic, as an a *posteriori* science, can be given in his own words, by considering the science as of " the most general laws of correlation among existences considered as objective ;" and again, a science involving " in its propositions certain connexions predicated, which are necessarily involved with certain connexions given ; regarding all these connexions as existing in the non-ego—not it may be under the form in which it may be, but in some form."

The processes of naming, definition, classification, generalization, inference, &c., employed upon hypothesis or facts established from observation, experiment, perception, or intuition, are means of

attainment of truth ; and *attainment of truth is the Province of Logic.*

Of those, taking all truth to· be the end of Logic, a most eminent one is Ueberweg. His definition has been already quoted, and its defect has been shown.

The end of Logic has been already known to be truth ; and it should be borne in mind that the aim of knowledge is truth. Logic is a science absolute inasmuch as it stands in relation to the activity of knowledge, aiding and furthering it.

Whatley considers Logic, in the most extensive sense, as the science, and also as the art of reasoning. "It investigates the principles on which argumentation is conducted, and furnishes rules to secure the mind from error in its deductions."

Hamilton criticises Whatley, and maintains that Logic is exclusively a science, and not an art. He seems to confuse the distinction between science and art, and to assert that such a distinction is too difficult. John Stewart Mill in his *Examination of Hamilton's Philosophy* shows himself very reasonable in supporting Whatley. He shows, how an art can never be possible without its being deduced from a science. Science differs from art as theory does from practice. Every science must have its

theoretical as well as practical aspects. Inasmuch as the former is concerned, it is purely a science ; inasmuch as the latter aspect is taken into consideration, it is an art. Looked upon in such a light all sciences, such as ethics, politics, &c., &c., are to be taken both as arts and sciences.

Truth, the correspondence of thought with its object, may be *formal* or *real.* The presence or actual existence of the object of thought makes truth *real* : when the absence of any self-contradiction is taken into consideration, and not of the actual existence or non-existence, it is *formal.* Logic is formal or material, according as its province is the latter or the former.

Hamilton belongs to the class of formal logicians, Mill and Spencer to the material class. Terms, propositions, arguments are all we have got to deal with in a formal Logic. Material Logic deals with not what is actual, but with what is possible. Formal validity, or real validity, or truth of thought renders *the general definition of Logic formal or material.*

The three main divisions or parts of Logic :—

I.—Of conception and concept. II.—Of judgment. III.—Of reasoning or inference. To the three above another may be added, *viz.,* IV.—The method of combining, or systematizing a series of

reasonings in a discourse form. According to Pro-
fessor Baynes this method can be of two kinds
(*a*)— *Of analysis or the method of resolution.* (*b.*)
— *Of synthesis or the method of composition.* These
two are respectively the same as (*a.*) the method
of invention and (*b.*) that of composition.

Logic is the science of principles or processes
not directly of phenomena, material or mental ;
it is, therefore, called the most general and abstruse
of all the sciences, having for its next branch, or
the one immediately following it, Mathematics.
All other sciences, either physical or mental, are
subordinate to Logic and Mathematics.

Professor Robertson speaks of *the* 'fourth depart-
ment ' as not transcending the bounds of Logic.
The use what we can make of it, he says is, when
set forth, to produce a combined effect on the mind.
The method is synthetic. All teaching involves
the process. But all the discoveries of truths must
have been successful, simply through *analysis.*
Synthesis is the process to demonstrate that the
truth attained is true. " A blending of both
methods, when possible, is doubtless 'most effective ;
otherwise it depends on circumstances."

From a summing up of all the different views of
the science held by logicians, we have seen that,

it can be either *material* or *formal*; logicians in general, however, unanimously hold that, its business is with formal correctness, or freedom from self-contradictions and with the justifiability of the conclusion, and not with the truth or falsity of its conditions or premises.

SECTION II.

FUNDAMENTAL PRINCIPLES.

Logic has been very often called *Scientia Scientiarum*—the science comprehending all other sciences.

The first principles of Logic may be taken as belonging to the three following classes :—

I.   Principles of Necessary Truths.

II.   Principles of Deduction.

III.   Principles of Induction.

The first class consists of what we call the Fundamental Principles of Logic.

The principle of consistency as noticed while giving an account of Mill's view of Logic, gives rise to the four *Fundamental Principle of Deductive Logic; viz.*, that of (1) Identity, (2) Contradiction (3) Excluded Middle and (4) Non-equivocation. Of these four, the first is really the foundation of all Logic, and from it, the second and the third can be shown to have been deduced. The fourth seems

superfluous by reason of its having a character ex-
planatory to the first one.

(1). 'M is M' or 'I is I' ; in any position, or
under any circumstance whatever you place M or
I, the value of each must remain unaltered. M or
I is what it is, and cannot be anything else. This
principle pre-supposes the absolute fixity and per-
manence of relations as those of the mathematical
figures, and guards us against any alteration after
we have once started.

(2). 'M cannot both be N and not-N' or 'I can-
not both be (95)° and (not-95)°.' (By not-95)° stu-
dents ought to know that it is a negative quantity
i. e minus (95)°. These are really so many combi-
nations of two simple propositions ; as, 'M cannot
be N,' and 'M cannot be not-N ' ; 'I cannot be
(95)°,' and 'I cannot be not-(95)°", because the two
contradictory terms and 'N' not-N,' (95)° and
'not-(95)°" like 'red' and 'not-red ' cannot both
be true of the same individual at the same time,
and under the same circumstances ; the statement,
that two contradictory propositions cannot both be
true, is shown as conclusive.

(3). 'M is either N or not-N' 'I is either (95)°
or not-(95)°' of the two contradictories, 'N' and
'not-N,' or '(95)° ;' and '(not-95)°" one of the
every two must respectively be equal to 'M' and

'I.' The difference then between the axioms of contradiction and that of the Excluded Middle is to be found in the fact that, the former denies the truth, and the latter the falsity of both the contradictories of one and the same term at the same time.

An exception to the second and the third Principle :—Both the contradictories can be false of the same subject i. e., 'M' or 'I' when 'M' or 'I' is taken universally, and false when the subject is taken partially. A concrete example is enough to make it clearer to the student. Of the proposition 'Men are poets;' when I qualify the subject to make it universal, the two contradictories 'poets' or 'not poets' are both false of 'All men'; and again they may be both false of the particular subject 'some men.'

The opposition in the second and third Fundamental Principles must always be borne in mind to be one of contradiction; and when this becomes a relation of contrariety the cases form so many exceptions to the Principles of Contradition, and of Excluded Middle. In relations of contrary opposition (a) both can be false; and (b) both can be true. The former case of exception has been characterised by Kant as *Dialectical Opposition.*

Hamilton in his Lectures postulates saying that
it is the business of Logic to give 'explicitly in-
language all that is implicitly contained in the
thought.' By giving this postulate of Logic,
Hamilton means to say that, before we use some
term, proposition, or argument for logical purposes,
it is necessary to determine its meaning, and no-
thing but verbal alteration for the proper logical
form can be possible after the determining of the
meaning.

Ueberweg also gives four Axioms or Fundamental
Principles, but in addition to all given here, he
gives another, *viz.*, the Principle of sufficient reason.
But they are counted to be four in all by reason
of the Principle of Contradiction, and that of the
Excluded Middle being included in one, *viz.*, the
Principle of Contradictory Disjunction; as in,
' A is either B or is not-B.' Like Mill, Ueberweg
also admits the importance of the Axiom or Princi-
ple of consistency which he sums up in the state-
ment ' A which is B. is B.': this, as has been already
said, is deducible from the First Principle.

Aristotle's Dotum de omni et nello ; *the Canons
or principles of syllogism,* and *the Mathematica
Axioms* can be considered in order as forming the
fifth, the *sixth,* and the *seventh* Axioms, or Funda-

mental Principles of Logic. These are to be given fully in the chapter on syllogism.

The question of the Fundamental Principles of Logic being placed at the outset of a work on De-. ductive Logic, in the beginning of Part II, or of Part III of it is indeed important. Bain takes the principles to belong to the same category to which Principles of Induction and Deduction belong. Mill allots to them room just where he begins his second part ; whereas Ueberweg takes them to be a part of the Inferences. The reason why we should place it in the beginning of a work on Logic is that the Principle of Identity deals not with judgments, but with terms. But this reason does not seem to be too potent specially to formal logicians. There is a relation between the same thing taken twice over; and that relation is nothing but a judgment. ' M is M ' is an identical proposition from which an inference to be immediately drawn would be ' M is nothing but M.' It is to be seen at once that the second and the third Fundamental Principles are clear instances of immediate inferences ; for in these from falsity, we come to truth ; and from truth to falsity.

PART I.

ON TERMS.

CHAPTER I.

Hobbes in Chapter II. of his *Computation* or *Logic* says, " A name is a word taken at pleasure to serve for a mark which may raise in our mind a thought we had before and which being pronounced to others, may be to them a sign of what thought the speaker had before in his mind."

A name serves two purposes : it enables us to recall to our mind some object of our previous thought, and forms a sign whereby *to make known* to others what we mean.

It is but fair to begin a work on Deduction Logic with an examination of names ; the reasons may be thus stated :—

(1) Knowledge in a logical form is made up of words.

(2) Names are the sources of all errors, and numerous fallacies.

(3) It is through the existing vocabularies of mankind that a glimpse of the past and present of things are to be had.

A name, says Mill, is a sign for communication. It consist of a word or a combination or words stand-

ing for something material or mental, real or imaginary; of mental and material both, may signify noumena or phenomena, substances or attributes.

Mill's theory of names may be thus summarised in his own words :—A name is a word " concerning which when we employ a word, we intend to give information."

Terms are the extremes of propositions. In its wider sense, it is a name of the product of conception or of an individual or individuals. Every term can be used as the subject or the predicate of a proposition either in its given form, or in a verbally altered form.

A word or combination of words of which something can be affirmed or denied, is the *Subject* and that which can be affirmed or denied of such is the *predicate*. Words or combinations of words which can be used as terms are *Categorematic*, and those to be necessarily joined to others for the purpose are *Syncategorematic*.

Nouns, pronouns, adjectives, verbs, can be *Categorematic*. Conjunctions, propositions, and adverbs are non-categorematic. Of the four parts of speech, verbs are spoken of by Whatley as mixed words, since in Logical propositions, they are to be resolved into copulas ; or the primary forms, of the verb to be and participles ; pronouns are not

usually taken in Logical propositions and arguments as terms. There is some difference of opinion among logicians, as to the capabilities of adjectives by themselves to be used both as subjects and predicates of propositions.

We can classify terms as in the following :—

TERMS.

(1)   (2) (3) (4) (5) (6)   (7) (8) (9) (10) (11) (12) (13)

(14)
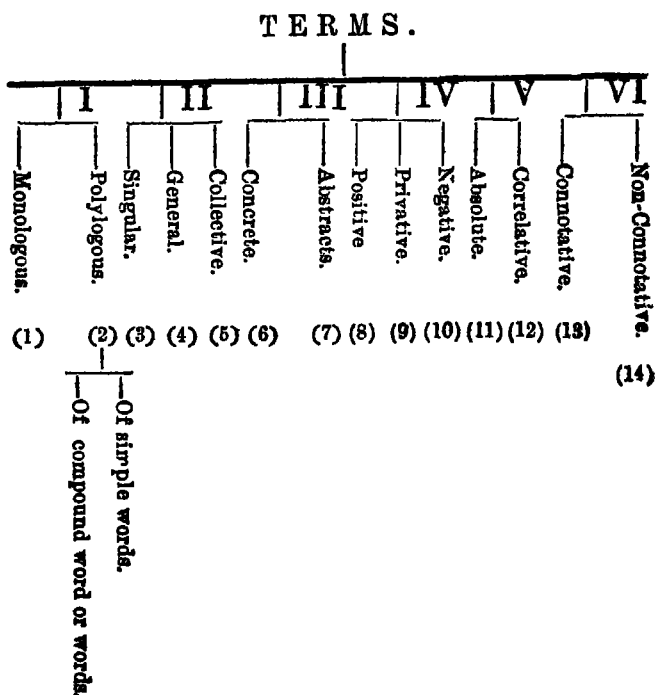
No logical term can be used in more senses than one.

I.—*A monologous term* or a single-worded one is complete in one word ; as 'man,' 'horse.' (I)

A polylogous term or many-worded one is complete in more than one word ; these can consist of (a) compound words, or of (b) single words ; ' rose-tree' or ' men of letters.' (2)

II.—*A singular term* is the name of an individual ; as, ' book,' ' Johnson.' (3)

A general term is the name of more than one individual thing and is applicable to each of an indefinite number ; as, ' man', ' flower'. (4)

A collective term is a name of a group of things considered as an individual ; as, 'army,' ' class,' (5)

A general term differs from a collective one in its applicability to each individual of the indefinite number comprehended under it. A collective term can be applied to a group only, and not to each member forming it.

Hamilton with other logicians takes ' regiment,' ' nation ' and similar terms to be general terms. These logicians demand, that collective terms in order to be distinguished from the common ones, must have an indefinite article prefixed ; as, ' a regiment,' ' a nation,' &c.

A general term, inasmuch as it is a name of individuals, is denotative, and, inasmuch as it implies attributes common to the members of the class, is connotative. Individuals of a class of which it is

a name and the attribute or attributes common to them, are said to be denoted and connoted by a general term.

The connotations and denotations of general terms can again be the abstract and the general terms.

III.—*An abstract term* is the name of an attribute or a group of attributes apart from the substance to which it belongs; as, ' animality,' ' goodness,' ' whiteness.' (6)

A concrete term is a name of a substance or an individual; as, ' man,' ' horse.'

Adjectives are all general, and not singular terms. *Abstract terms* again can be *singular* or *general.* They are general, when names of some groups of attributes, and names of each member of the groups; as, ' virtues,' ' pains '; singular when names of definite individual attributes ; as, ' redness,' ' whiteness.' (7)

Attributives differ from abstract terms in being in an adjectival form, and in not being used as the subject of a proposition. Abstract terms can be used both as the subject and the predicate of a proposition ; whereas attributives can be used simply as predicates.

IV.—*A positive term* indicates the presence of

an attribute or substance. (8)

A privative term indicates the temporary absence of an attribute in an individual, and thereby pre-disposing its capability for it. (9)

A negative term indicates the absence of an attribute. (10)

EXAMPLE:—Positive, 'wise;' privative, 'ignorant' or 'blind'; and negative, 'not-wise' or 'unwise.'

The last three terms can be abstract as well as concrete. They are *abstract* when the presence or absence of attributes only is implied; *concrete*, when the presence or absence of substances is indicated.

V.—*An absolute term* is one which can stand by itself without associating with it, or being asso-ciated with any other term; as, 'bird,' 'tree,' &c. (11)

A correlative term is a name of an attribute, or substance associating with it another name of a related class. Both, in relation to each other are correlatives; as, 'master,' 'servant'; 'husband,' 'wife,'; 'teacher,' 'pupil;' &c. (12)

VI.—*A connotative term* is one denoting an individual and connoting an attribute; as, 'man,' 'metal.' (13)

A non-connotative term indicates either an in-

dividual or an attribute ; as, ' breadth,' ' whiteness,' ' Pearson,' &c. (14)

The connotatives are :—

(a.)—All general concrete terms.

(b.)—Certain general abstract terms, or certain general terms that are abstract.

(c.)—Certain *singular* terms having denotation and connotation both.

The non-connotatives are :—

(a.)—All singular abstract terms.

(b.)—Singular terms having denotation only.

CHAPTER II.

The Denotation and Connotation of Terms.

The denotation of a term is a representation of the individuals, designated by the term. But such a representation must always be made in the same sense and no other.

The connotation of a term is the meaning of the attributes, or groups of attributes common to all the individuals denoted by the term. In ' man,' for example, there are two groups of attributes, 'animality' and ' rationality,' and these are its connotation; it means individuals belonging to the

race of mankind, and this is what is called its denotation.

When the denotation of a term increases, its connotation decreases with it, and when the con notation increases, the denotation decreases accord· ingly. A glance at the diagram will be enough to give the student an insight into the above truth.

We take the three terms 'man,' 'philosopher,' and 'Socrates,' each designating a number of individuals greater than the one following, whereas having the connotation of each less than that of another. The terms are represented respectively by the three concentric circles. 'Socrates' which is but an individual has the least denotation ; its connotation will give the whole group of attributes, it possesses. The smallest circle having the same centre with the other two shows that, in proportion to the space occupied by the one representing 'man,' the connotation of the term having the greatest denotation, is the least, and that of the next, less. The connotation of an individual is the greatest possible, since the whole space representing the attribute common to all the individuals of the class is only as much as is occupied by the last, viz, 'Socrates.' The connotation of an individual
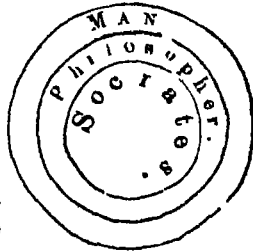
is as much as its attributes are; and its connotation and denotation both can, therefore, be represented by the smallest circle itself. ·

The other expressions for *denotation* and *connotation* are *extension* and *intension*.

Formation of less general terms from more general ones means *Determination*. The terms *content* and *extent* are substituted by Ueberweg for *denotation* and *connotation*. The denotation of the less general terms is increased by the addition of new elements of conception appropriate to the object conceived, and what remained undetermined in the more general notions becomes more closely determined.

The relation between the denotation and connotation of a term is best expressed by Sir William Hamilton in his Lectures on Logic, Vol. I in words which make him differ little from James Mill and other sensible authorities. Hamilton says, " these two qualities of comprehension and extension stand to each other, always in an inverse ratio. The greater the comprehension of a concept the less its extension, the greater its extension the less its comprehension." A German logician Drobisch endeavours to explain this relation mathematically. He tried to disprove the relationship of an *inverse* ratio between the denota-

tion and connotation of a term, and to establish for his conclusion the fact that the size of the extent decreases in geometrical progression, while the size of the content increases in arithmetical progression. He carries the question furtheron and explains it with reference to logarithm of a number. But it can be easily understood that the peculiar limitation given rise to by instances renders application of this investigation useless in most cases.

James Mill expresses the relation between the denotation and connotation of a term thus ; " The denotation and connotation of a term vary inversely." The proposition can be proved as follows :—

Let a be the denotation, and b the connotation of a term. $a \propto \dfrac{1}{b}$ can be shown to be the relation existing between them. Both the terms of a ratio multiplied or divided by the same term do not vary in relation ; they may do so in their individual value. Both the terms a and $\dfrac{1}{b}$ of the variation being multiplied together at the time, and by the same term will maintain the same ratio between each other, although their value as individual terms must increase. But the most important fact to be here noticed is that *as the integer gains, the fraction looses,*—the more the one looses, the

more tho other gains. This is what we find.in an example of an inverse ratio ; and this is exactly what we notice in the relationship between the denotation and connotation of a term. Take for instance, the term ' man,' and ' philosopher.' The latter is a fractional term inasmuch as it refers only to a section of the human race. In denotation it is less, but in connotation it is considerably greater. A clear explanation of the fact can be easily given on the strength of this example.

The denotation of a term wi¹l neither increase nor decrease, if its connotation is increased by the attribute or attributes to be found common to all the members of the class ; similarly connotation will remain the same, if, to the number of individuals denoted by the term are added any other individuals known to possess attributes common to the class. This will appear evident from the diagram above, by enlarging the circles.

The denotation and connotation of a term cannot be permanent as long as the different branches of scientific investigation do not reach their goal of perfection. None knows for instance, when Chemistry will discover another kind or class of metals yet unknown.

A genus is a general term applied to a broader.

class including narrower ones.

A species in relation to genus, is a narrower class contained in a broader one.

A differentia is an attribute which distinguishes a genus, not only from a species, but also from the species contained in the same genus. The differentia of a species, when added to the connotation of a genus, gives the connotation of the species. The student is referred to the preceding diagram for an illustration of what has been said of the differentia and its relations. Let the connotation of the singular term, 'Socrates' be represented by $x+y+z$, and that of 'Philosopher' by $y+z$, and that of 'man' by z only. It can be seen that, by adding, the differentia y of the species, 'Philosopher' to the connotation z of the genus 'Man,' we get the connotation of the species, 'Philosopher,' *viz.*, $y+z$.

If, for instance, 'Living being' be taken as the sumum genus, or a term signifying the widest class divided into several species, 'Man,' 'Philosopher,' 'Socrates' are to be taken as co-ordinate in their own relation, and subordinate in relation to the ' Living being.'

When one term excludes another, both are called *contradictories*; as, 'man,' 'not man.'

The affirmation of one of these, is the negation of the other ; and *vice-versa.*

If the relation between the two terms be such that the affirmation or negation of both in reference to one and the same thing be possible, so that the truth of the one proves or establishes the falsity of the other, but not *vice-versa*, they are *contrary terms;* as, 'black' and 'white.'

Two contraries do not take up the whole range of thought, whereas two contradictories do so.

CHAPTER III.

THE DEFINITION.

A *definition is an exhaustive statement of the* connotation of a term. It may be of a term, or of the individual or class denoted by the term. It is more or less complete, as the connotation set forth is more or less exhaustive. Concepts, like terms, have contents or comprehension and extent or apprehension. A definition can, therefore, be said to be a process of determining the connotation of a term. The process involves observation, analysis, abstraction, and generalisation, and is most important in science.

Definitions can assume various forms from various points of views. They can be taken as

1. Nominal and Real:—

A Nominal definition furnishes us with what is

to be understood by an Expression. A real definition concerns itself with the internal possibility of the object denoted by the notion defined, and, therefore, with the real validity of it.

2. Substantial and Generic:—

A Substantial definition is that in which the content of the notion to be defined is taken from the present existence. In a generic definition the content is taken from the origination of its object.

3. Essential Definition, and Distinctive Explanation:—

An Essential Definition gives marks that are constitutionally essential; whereas Distinctive Explanations give marks that are secondary.

4. Analytical and Synthetical Definitions:—

An Analytical Definition is formed in accordance with the present mode of conception in sciences or with the existing use of speech. A Synthetical definition is formed fresh and freely, independently of any demand or agreement with the present use or want.

5. Description, Explanation and Exposition :—

All of these are strict forms of explaining what belong to the content of the notion; and so they are related to Definition.

The circle in a definition is often called a Dial-lelon.

Formation of valid concepts, and of adequate definitions and divisions is not to be perfect from a sufficient knowledge solely of logic. It must depend on one's familiarity with all the sciences the objects of which are to be symbalised, defined, and divided. One should, therefore, be fully conversant with the facts of all the various branches of human knowledge before being in a position to give concepts, definitions, and divisions of them adequate for the purposes of sciences.

A definition can be *valid*, on the following conditions:—

(1). That to be complete, it has all the connotations of the term defined, or it may be a statement of the genus and the differentias of the term.

The violation of this rule is a case of an accidental definition, or a mere description of the things denoted by the term. The examples; 'A square is a rectilinial figure, having the opposite sides equal and parallel, and the four interior angles together, equal to four right angles,' and 'Water is liquid' are instances of redundant and incomplete definitions. 'A child is an embodiment of simplicity' is an instance of description.

(2). That it is equal to, but not more than, the denotation of the term defined. The violation is an instance of the too great width or narrowness; as, 'All men are living beings,' &c.

(3). That it do not contain any term synonymous to the term defined; as, 'a sound is sonorous,' &c. In such a case, the circumstances of the origin of the term are given, and hence they can be descriptions.

(4). That no ambiguous or doubtful language be used in it, or in other words, no rhetorical expression, capable of various interpretations be used; as, 'The governing class is but the stomach to the different limbs of the body.'

(5). That negation be avoided where affirmation is possible. The violation is but a case of almost meaningless definition; as, ' Spirit is not physical,' &c.

CHAPTER IV.

THE DIVISION.

A Division is an exhaustive and systematic state-ment of the denotation of a term. The grouping of it into smaller classes must be according to the pre-sence, or absence, or varying degree of an attribute. This logical division has nothing to do with physical

or metaphysical division, the former being an analyzing or separating of an individual thing into its components, while the latter, into its constituent attributes.

Division can be valid, provided that—

(1). No individual be taken for division. A singular or a collective term is therefore inadmissible in division. The former, and the latter, inasmuch as they are considered to be singular, are instances of physical or metaphysical partition; as, 'men' into hands, feet, &c. ; and 'regiment' into soldiers ; and 'mind' into cognition, volition, &c.

(2). It be according one *fundamentum divisionis*, or Principle of Division.

(3). The name of the class divided, may be in the same sense applicable *to the smaller groups* into which the whole class is divided.

(4). The groups into which a class is divided be, when taken together, equal to it in extent. The violation is an instance of an incomplete or over-complete division.

(5). The dividing groups do not overlap, but entirely exclude one another. This last is a deduction from the fourth.

A *Fundamentum divisionis* is the presence, or absence, or the varying degree of a certain funda-

mental attribute. Thus, in dividing a rectilinial
triangle into 'equilateral,' 'isosceles,' a nd 'scalene,
we take cognition of certain fundamental attribute, *i.e.*'
'equality or inequality of sides.' There are instances of
the equality and inequality of angles, &c. Another kind
of division, and that, strictly speaking, the only pro-
cess used in Deductive Logic, is called Dichotomy.
It means dividing or cutting into two. The division
into two according to the Principle of Excluded-
Middle covers the whole range; as,
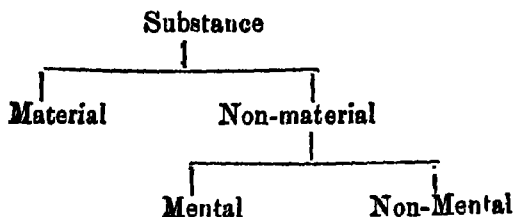
Adding up the series of the left-hand divisions,
the subordinate divisions, or the dividing members
are to be found.

PART II.

PROPOSITIONS.

CHAPTER 1.

The relation of affirmation or denial of a certain term of certain other term is a proposition. There are two terms in a proposition. Of the two terms one is the subject, and the other the predicate.

That of which something is affirmed or denied is the *subject,* and that which is affirmed or denied of something else, is the *Predicate*; and the primary forms of the verb to be, with or without the negative particle, is called the *Copula.* 'All poets are imaginative,' 'Some people are careless'; 'Poets' and 'people' are the subjects, and 'imaginative' and 'careless,' are the predicates in the first and the second propositions respectively; the first is affirmative on account of the primary form of 'be,' not being joined together with the negative particle; and the second negative, on account of its being joined together with the negative particle. Without any consideration as to what the philosophers in the different systems hold, as regards the copula, among the logicians themselves, we notice a difference of opinion on its

function, and the difference arises from the indecision of the fact, whether it can or cannot imply existence.

According to the grammatical forms of sentences' we can classify propositions as simple, complex, and compound ; but considering that the subordinate clauses of a complex sentence are mere enlarged forms of the different parts of a simple sentence, we can save the division or classification of any complication by taking them under the two general heads; viz:.—1. Simple. 2. Compound.

Divisions or Classification of propositions—

The most ordinary division or classification of propositions is according to (1) Quality into (a) Affirmative and (b) Negative; and (2) Quantity into (c) Universal and (d) Particular. But in addition to these heads of division, it is necessary for the student to remember the three others, i.e., (3) Relation, according to which propositions can be divided into (e) Unconditional or Categorical, and (f) Conditional or Hypothetical; (4) Modality, conveying degrees of belief according to which propositions can be divided into, (g) Doubtful or Problematic; (h) Assertory or General Affirmative and (i) Necessary; and, (5) Import according to which these can be divided into (j) Analytical or verbal, and (k) Synthetical or Real.

'1). Division according to Quality—

    (*a*)—*A proposition* is *affirmative* when the predicate is affirmed of, *i.e.*, the connotation implied by it belongs to the subject; or when the denotation of the subject is contained in that of the predicate. In cases of hypothetical propositions, the consequent depends on the antecedent.

    (*b*).—A *proposition* is *negative,* when of the subject, and the predicate, neither the denotation nor the connotation is contained in, or related to, that of the other.

In case of an hypothetical proposition, the consequent depends on the antecedent.

Examples:—

    ' All men are fallible. ' 'If one tries, one succeeds.'
    ' No man is infallible.' ' If the wind be strong, there will be no rain.'

(2) Divisions or classification according to Quantity—

    A *categorical proposition* is *universal* when the subject is taken in its entire extent ; as, 'All men are mortal.' 'No man is infallible.' *A categorical proposition* is *particular* when the subject is taken in its partial extent; as, 'Some men are poets,' 'Some men are not thoughtful.'

Sometimes a proposition is neither universal nor particular, by reason of its subject not being qualified ; in such cases they are called indefinite.

'Teachers are men of experience.'

'Animals have digestive organs.' An exact ascertainment of the quantity of these propositions cannot be made, without referring to the sciences to which they respectively belong.

Propositions are universal or particular, according as the predicate in each of them is affirmed or denied, either of the whole of the subject or of a part of it.

A proposition of which the subject is a singular or a collective term, can be singular as well as universal ; *singular*, when the subject is a general term, prefixed by an indefinite article ; as 'A Christian is never afraid of death ;' and *universal*, when it is a true singular term ; as, 'Mr. Gladstone is an orator of world-wide fame.'

A proposition is universal or particular, according as the individual of a class forming the subject, is pointed out by any descriptive words, some demonstrative pronouns, or by some indefinite numerals.

The universality and particularity of a proposition, depends respectively on the universality and cogency of the circumstances of accompaniment of

the connotation, or intension of its predicate with the subject.

An hypothetical proposition is *universal*, when the antecedent and the consequent are of an invarible relation; and *particular*, when the consequent is of some case of the antecedent.

EXAMPLES.—(1) If air is heated, it rises in temperature.

(2). If you put your finger into the fire, it burns.

(3). If water is heated, it is turned to steam.

THEIR OTHER FORMS :—

(1). In all cases, 'if air is heated, it rises in temperature.'

(2). In all cases, 'if the finger is put into the fire, it burns.'

(3). In some or certain cases, 'if water is heated, it is turned into steam.'

From what has been seen above, it will be apparent that—

All universal affirmative propositions distribute their subjects.

All 'universal negative propositions distribute

All particular affirmative propositions do not distribute either the subjects or the predicates.

All particular negative propositions distribute their predicates only.

The sign for all Universal affirmative proposition is A.

     ,,   ,, Universal negative is E.

     ,,   ,, Particular affirmative is I.

     ,,   ,, Particular negative proposition is O.

The *opposition* between any two universal propositions, differing only in quality, is *contrary*, and *that* between two particular propositions differing in the same respect, is *sub-contrary*. Some logicians do not make any distinction between contrary and sub-contrary relations.
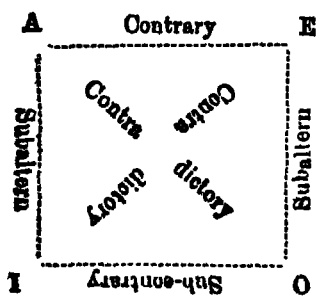
The opposition between propositions differing in quantity only, and not in quality is *subaltern,* and that between two differing in quality and quantity both is *contradictory.*

(3). Division or classification according to Relation :—

A proposition is unconditional or categorical, when the affirmation or denial of the relation be-

tween the subject and the predicate is a simple
and independent one; as, 'All metals are ele-
ments,' 'Some men are not philosophers.' A sub-
junctive or conditioual proposition is one of which
the affirmation or denial depends on certain con-
dition; as, 'If gold is heated, it will melt.'

Conditional propositions are *hypothetical, disjunc-
tive* and *disjunctive-hypothetical,* inasmuch as they
contaiu more thau one proposition. It has been told
that the two clauses of an hypothetical proposition,
which are but the antecedents and consequents, are
equal in value to two polylogous terms. In
the example; 'If gold is heated, it melts,' the clauses
of the autecedent and the consequent can be seen
resolvable iuto two terms: then it will be :—'The
case of the heating of the gold, is the case of its
melting.'

*(4). Division or classification according to modal-
ity or degree of belief—

A *proposition* is *necessary,* when the relation
between the subject and the predicate is based on
the esseuce and coustitution, *i.e.,* when the truth of
the relation is universal and necessary; as, 'A like
effect must have a like cause.'

A *proposition* is *common affirmative* or *assertory,*
when the relation is based on experience, but does

not imply necessity; as in the example, 'Water every-
where undergoes evaporation;' it is tacitly assumed
that, in certain cases, there being circumstances
under which evaporation is impossible.

A *proposition* is *problematic*, when the relation
between the subject and the predicate is probable,
and that the relation is expressed by 'probably,' 'may
be,' &c.

(5). Division according to import—

A *proposition* is *verbal*, when the predicate is
equal to or less than the subject in connotation ; in
other words, when the predicate, in relation to the
subject, is a genus, species, or differentia. A *proposi-
tion* is *real*, when the connotation of the predicate
is not contained in that of the subject, in other words
when the predicate, in relation to the subject, is a
proprium or an accidence. The other names of the
verbal and the real propositions, are Analytical and
Synthetical.

The Predicate in the first of the two cases gives
the entire or partial meaning of the subject; in the
second, connotation, something in addition to the
connotation of the subject.

Examples :—

For the former case, 'All men are rational.'

" latter case, 'All men are mortal.'

The five Predicables, are Genus, Species, Differentia, Proprium, and Accidence.

It has been seen that of the two terms related to each other, as genus and species, the connotation of the second, minus that of the first, is what is the differentia of the species.

A genus is a wider class including narrower classes or species

A species, in relation to the genus, is a narrower class contained in the larger, the genus.

A genus includes its species only in denotation, but in connotation it is included by its species.

A differentia is an attribute distinguishing one species from some other of the same genus, and which is but a part of the comprehension of the species.

An *individual* is some one thing or substance of which the attributes known or unknown include within themselves the comprehensions of the species and the differentias.

From the above we can establish the formula: *the connotation of the genus—the connotation of the species = the differentia.*

From the equation, given any two, we find out the third. The extent of a differentia is greater than

that of the species or genus; in some cases only, it is equal. The extent of the differentia is theoretically greater than that of the species, by reason of its less comprehension.

A proprium or property is an attribute following deductively from the genus, species, or individual, either as an effect from a cause, or as a conclusion from premises. It can be generic, specific, and individual, according to the nature of the term, of which it is a comprehension ; as, memory, and power of judgment of the mind, and sensibility of the nerves. *An accidens* is any attribute of an individual, genus or species, but which is neither a part of, nor is inferred from the comprehension. It is inseparable or separable, according as the attribute belongs either to an individual, to all the members of a genus or species respectively ; or, as is sometimes present and sometimes absent in an individual, belonging to a part only of a genus or species ; as, Sodium begins to melt at 97° temperature, is an example of inseparable accidence ; but blackness of a crow is a separable accidens.

Genus, species, differentia, proprium, and accidens are called predicables, because some one of these in every case, can be used as the predicate of a proposition. Whatever is affirmed or denied of a given term in relation to the subject, is a Predicable. *Summum Genus* is the highest genus, which cannot be used as a

species. *Infima* Species, is the lowest species which cannot be divided into other species: these can be divided into individuals only.

Subaltern genera and species are the intermediate genera and species.

The terms Summum Genus and Infima Species are expressions used by the logicians of old.

CHAPTER II.

The doctrine or theory of Predication and the Import of Propositions.

A theory is always opposed to practice. It is a system of explanation of a truth or principles.

Predication is but another name of a proposition. The predicate of a proposition is the essence of it; for, without it the proposition does not carry any importance, and it does not differ from a concept or a term. Something must be predicated of a concept or a term before it can be a predication or proposition. The theory that teaches us how to determine the position of the subject and the predicate of a proposition, and a relationship between them is the one of predication.

Import of a proposition is the meaning or tend-ency of it. This is often difficult to ascertain:

it can be various according as the tendency of men varies.

Opinions of different writers on the important subject should be noticed with interest. Hamilton, Mill, Mansel, Ueberweg, James Martineau, and Bain, among the many, present striking points of difference. The views of these are stated below :—

I.—A judgment, according to Hamilton, is the subsuming of one class under another ; and the predicate and the subject are respectively greater as the notions are taken in their extent and content. To keep closer to Hamilton's own language, we should define a judgment as the recognition of the relation of congruence or confliction between two concepts, two individual things, or a concept and an individual. A judgment, when expressed in language, is a proposition. Hamilton finally defines a judgment as the product of that act in which we pronounce, that of two notions thought as the subject or predicate. One does or does not constitute the part of the other, either in quality or extension, or in quantity or comprehension. If the subject be taken as the containing whole, we have an intensive or comprehensive judgment : if on the other hand the predicate be taken as the containing whole, we have an extensive judgment. Hamilton developes this dis-

tinction, afterwards, into comprehensive and ex-
tensive forms of syllogism.

II.—Mill begins his chapter on the theory of
Predication with asking a number of questions on
the nature of judgments, the object of belief, and
the evidence of the truth involved in a proposition.

The joining of the two names," says he, by the
peculiar mark of Copula, "is the act which has
been denominated predication." A proposition
from his sense of the term is only of the noumena
and not about the phenomena, *i.e.*, about the
things themselves, and not about concepts or ideas.
The view which maintains the relation between
the two ideas corresponding to the subject and
predicate of a proposition, is to him a fatal stumbl-
ing block in the way of the expected advance of the
science of Logic. Hobbe's theory states, that the
predicate is the name of that of which the subject is
a name. Mill refutes this on the ground that except
in the case, in which both are proper names, it is
untenable. There is another case, however, where
the theory can be seen as holding good, and that
is from the equational views of the proposition;
as in 'Man is a rational animal'! Class theory of
proposition cannot be, like Hobbe's theory, univers-
ally applicable.

The equational view of propositions follows directly from Hamilton's theory of qualification of the predicate. The theory, as adopted by Hamilton, and imitated and developed by Thomson, will be explained further below. Mill's theory is really connotative or attributive, since it expresses a relation between the phenomena on which the attributes are respectively founded, and which are to us the means of recognition of the relation. The relation between the phenomena is of *co-existence*, *succession*, *causation*, *resemblance*, or mere *existence*. It is further asserted in his Logic that, as the attributes, which the predicate connotes are possessed by each and every individual possessing certain other attributes, whatever has the attribute connoted by the subject has also those connoted by the predicate; and that the latter set of attributes constantly accompanies the former set. He shows, for instance, from the proposition, ' Man is mortal.' " Whatever has the attributes of man, has the attribute of mortality; mortality accompanies the attributes of man." " To possess an attribute," says Mill, is to be "the cause of or to form the part of the fact, or phenomena upon which the attribute is grounded."

The relation as expressed above can be between phenomena and noumens.

III.—Mill's fivefold classification, an exhaustive
classification of matters of fact into Existence, Co-
Existence, Sequence, Causation, Resemblence has, on
the suggestion of Professor Bain, been reduced to
three only: *viz.*, (1) Co-existence. (2) Succession
including Causation; and (3) Equality or Inequality.

The Professor does not take Existence as separate ;
the reason is that he takes Co-Existence in two
different senses; *viz.*, (a) in different places at the
same time; and (b) in the same place at the same
time.

IV. Mansel takes both the Subject and Predicate
as concepts, and the meaning of propositions, besides
those identical, is that the attributes implied by
the subject and predicate both exist in the same
individual thing or things except in equational pro-
positions ; therefore, according to Mansel, an assertion
of the relation of the subject and predicate does not
justify us in considering the attributes constituting
two concepts to be identical. But the two sets of
attributes are supposed by him, to have one and the
same object.

V. Ueberweg defines judgment as " The con-
sciousness of the objective validity of a sub-
jective union of conceptions, whose forms are
different, but belong to each other." The whole
weight of importance he attaches to the con-

viction, that the combination of conception has object-
ive validity.

VI. Doctor James Martineau thinks it natural to
take the predicate as an attribute, having reference
or belonging to the individuals denoted by the sub-
ject. To illustrate this, he takes the proposition
" Birds are warm blooded." " The term in the
predicate," he says, " acts on our mind" here
" by its connotation or in its comprehension ;
the term in the subject by its denotation or in its
extension." In the same essay he continues :—"The
mind predicates nothing, except about substantive
objects of thoughts " and " it predicates nothing but
attributes." He attempts to falsify the Denotative
or Class Theory of Predication, and Mill's Connota-
tive Theory.

Mill's classification, as modified by Bain, has been
among many objected to by Dr. M'cCosh. The objec-
tions may be thus stated:—

(1) Mill's five-fold classification is not an exhaust-
ive one.

(2) This statement of the meaning of Verbal Pro-
positions is not sufficient.

According to his theory, the meaning of a
proposition depends on what is, in a greater or
less degree doubtful, indefinite and variable. In the
proposition ' Man is mortal ' for example, ' mortality

depends on humanity;' to give a final definition of humanity is rather impossible.

Self-contradiction involved in Mill's statement in the chapter on Terms, and in that again on the Theory of Propositions.

In the former he speaks of the direct signification of objects and indirect signification of attributes of a common or general term; whereas in the latter, connotation, he has taken as the direct meaning, and denotation as its implied or indirect meaning.

In his *System of Logic* Mill, while introducing the subject of the *Import of Propositions*, determines that an inquiry into the nature of propositions leads to either of the two following processes; *viz.,* (1) Analysing Belief—a state of the mind, or Analysing what is believed. All the most distinguished philosophers of Germany, France, and England have to a recent date overlooked this distinctions; and hence, so much of confusion on the subject in question is in the history of Logic. The question is· so difficult and important that Mr. Mill says further on :—" To deteimine what it is that happens in the case of assent or dissent besides putting two ideas together, is one of the intricate of metaphysical problems." Mill's position with regard to the *Import of Propositions* will be very clearly ascertained from the passage quoted ·here :—"The notion that what is

of primary importance to a logician in a proposition
is the relation between the two *ideas* corresponding
to the subject and predicate, (instead of the relation
between the two phenomena which they respectively
express) seems to me to be one of the most fatal errors
ever introduced into the philosophy of Logic."

Hobbe's denotative theory and the class theory of
predication have been considered identical· by Mill,
and they have been very minutely refuted by him.

It is important to notice what Professor Bain
says on the law of universal relationship of Extension
and Comprehension. "The most generalised pro-
position," he says, "are those that have the smallest
predication; the extent is generally lessened, as the
predication is increased." This is what is said with
reference to the grades of generality of Propositions·

With reference to relativity the Professor says,
" To every proposition there exists a correlative pro-
position, something denied when it is affirmed.'Friend-
ship is pleasure' has, for instance, for its correla-
tive proposition, 'Friendship is not painful or indif-
ferent.'

The two ways for arriving at the highest generali-
ties of Predication are (1) a sufficiently wide ex-
amination of actual propositions in detail; and (2)
reference to the classification of nameable things.

PART III.

Reasoning or Inference.

Kinds of Reasoning or Inference.

From the view taken by logicians advocating the subjective system of philosophy, a reasoning is a process by which the mind arrives at a judgment different from one or more judgments as data. The process of reasoning in which a judgment is arrived at from another containing or implying it is called *Immediate*. The process, in which from more than one judgment another is arrived at and is justified by them all is that of a *Mediate Reasoning*. The judgment arrived at from one or more judgments is the *Conclusion*; the judgments or judgments from which they are arrived at, are *the Premises*. A *Reasoning is Deductive*, if the conclusion be less general than either of the premises in a Mediate Reasoning, and be in fact the necessary result of the combination of the premises; or, in short, if the conclusion is a distinct growth of what the premises contain or imply.

A *Reasoning* is *Inductive*, if the conclusion is more general than any of the premises. A point of disagreement in logic is whether Immedeate Inference can be both Deductive and Inductive. If it can be

Inductive, a more general conclusion can be establish-
ed from a single less general premiss; adopting
this view to be valid, we would have to divide Rea-
soning into Immediate and Mediate, and the latter
into Deductive and Inductive.

Deductive Logic has nothing whatever to do with
Induction and *Indicative* inferences.

Our classification therefore is as follows:—

```
                     Reasoning
                         |
          _____
         |                                |
      Deductive                       Inductive
         |
      _____
     |                          |
 Immediate                   Mediate
                                |
                _____
               |                          |
           Syllogistic           Mathematical &c.
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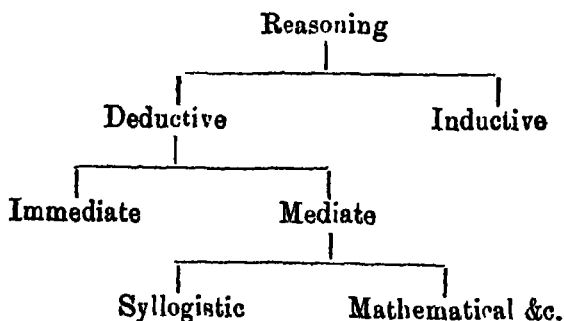
A Mediate Deductive Reasoning conforming to
the axiom of Aristotle, *Dictum de omni et nello*,
"Whatever is affirmed or denied of a class distribut-
ively, may be affirmed or denied of anything belong-
ing to that class," or some other similar axioms, is a
syllogism.

A Mathematical Reasoning, for instance, is Non-
syllogistic. Those only are mathematical, which
are based on one or other of the Axioms of Mathe-
matics, such as, (1) that things which are equal to
the same thing are equal to one another,—(2) that

the sums of the equal are equal, (3) the principle or Axiom called *Argumentum a forteriori*, that a thing, which is a greater than the second, greater than a third, is greater than the third."

From the view held by logicians advocating the objective system of philosophy, a Reasoning is an inference of a relation from one or more given relations among things or attributes. *An Inductive Inference* is a general or universal relation inferred from one or more particular relations. *A Deductive Inference or Reasoning* is a relation not more general than the given relation or relations, which contain or imply it. The word inference has its threefold meaning: *viz.*, (1) the process of reasoning (2) the product of reasoning, including the premiss or premises, and (3) the conclusion alone.

A Reasoning expressed in language, is called an Argument. An Immedeate Reasoning consists of two propositions, the one inferred and the other premiss from which it is inferred.

An Inductive Argument consists of many propositions furnishing us with data comprising particular instances by which the conclusion is justified. By defining Logic to be the science of the principles of correct reasoning, is meant, that it lays down the conditions on which the validity of the Reasoning must depend.

The validity of Mathematical reasonings must depend on their conformation to the Axioms of Mathematics. They may be reduced to syllogistic forms by taking the Axioms to be the major premises, and the data of the reasoning to be the minor premises; as in the following:—

∴. Things which are equal to the same thing are equal to one another—

The first and the second pieces of iron are respectively equal to the third piece of iron.

∴ The first piece of iron is equal to the second.

An example of Inductive Reasoning:—

Iron, when sufficiently heated, melts.
Gold, when sufficiently heated, melts.
Copper, when sufficiently heated, melts.
Brass, when sufficiently heated, melts.
Silver, when sufficiently heated, melts.

∴ All metals, when sufficiently heated, melt.

Inductive reasonings have their separate rules and canons. We can reduce them to syllogistic forms by taking the canons as major premises and the data of reasonings, as minor premises.

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CHAPTER II.

IMMEDIATE INFERENCE.

Of the two processes of Reasoning, the one is of inferring or deducing a proposition from a given term or from a given proposition or premiss. The deducing of a proposition from a single term is possible, by reason of the affirmability of the attributes connoted by it, as of the two groups of attributes connoted by the term 'man' *viz.*, 'animal' and 'rational' both can be affirmed of it, to form two distinct propositions; thus to have, 'Man is animal' and 'Man is rational' deduced from the term.

The second process is of inferring another proposition from a given proposition; as, from 'All men are mortal' can be inferred 'No man is immortal.' The classes of Immediate Inference are seven, *viz.*, (1) Conversion; (2) Permutation or Obversion; (3) Contraposition; (4) Subalternation; (5) Opposition; (6) Modal Consequence; (7) Change of Relation.

1.—*Conversion is the transposition, so far as it is admissible, of the Subject and Predicate of a proposition.* The proposition coverted is called convertend, the one inferred from it, is called the converse.

The following rules are to be observed in conversion—

The convertend must, without any change in the quantity and quality of either, be transposed.

I.—The subject and predicate in the convertend must, in the converse, change places.

II.—A term undistributed in the convertend should not be distributed in the converse.

III.—Quality of the convertend and of the converse must remain the same.

It is not by the process of conversion alone that the Subject and Predicate of different quantity, and quality can be transposed, as will be seen further below:—

EXAMPLES.—

Simple Conversion:—

I.—E. No man is infallible.

∴ E. No infallible being is man.

II.—I. Some readable books are big volumes.

∴ I. Some big volumes are readable books.

Conversion per Accidens :—

III.—All men are animate beings.

Some animate beings are men.

The different cases of conversion :—

(*a*)—I is deducible from A. This does not violate any of the above three rules, and will be evident from the diagram representing A.

(b.)—I is deducible from I. This can be evident
from the diagrams representing I.

(c.)—E is deducible from E. This can be evi-
dent from the diagrams representing E.

(d.)—O is deducible from O. This too can be
proved by the student by diagramic repre-
sentation. When the converse is the same
in quantity and quality, the *conversion is
simple* : as, I from I, and E from E.

When a particular converse is deduced from a
universal one, the conversion is *per accidens.*

2.—*Permutation or Obversion is a process by which
one proposition with the contradictory of the predicate
and with the contrariety of quality of another is
inferred from that other. The reference is the
Obversion or Permutation,* and the other proposition
is the *Obvertend.* A third name generally assigned
to this process is Æquipolence.

By this process :—

a.—E is deducible from A by permutation;.
as, from 'All men are fallible ' 'No man is
not fallible or infallible.'

b.—A is deducible from E by permutation;
as, from ' No man is omnicient ' we can
infer ' All men are not omnicient.'

c.—O is deducible from I by permutation ; as,
from ' Some men are poets' we can infer
' Some men are not not-poet.'

d.—I is deducible from O by permutation; from 'Some men are not poets' we can infer 'Some men are not-poets.'

Hypothetical propositions may likewise be obverted; as, from 'If it rains, the ground will be wet' we may infer 'If it rains, no ground will not be not-wet.' Inferences can be similarly drawn in all the remaining cases.

3.— Contraposition is a process by which the contradictory of the Predicate of the premiss is made the subject of the inference ; and the subject, the Predicate with the contrariety of quality.

The instances of contraposition :—

> (*a.*)—E is deducible from A ; as from, 'All men are mortal' is deduced, 'No not-mortal is man.'

> (*b.*)—I deducible from E ; as from, ' No man is perfect' is deduced, ' Some not-perfect beings are men.'

> (*c.*)—I deducible from O ; as from, ' Some elements are not metals ' is deducible, ' Some non-metals are elements.'

> (*d.*)—Nothing deducible from I.

Hypothetical propositions can be contraposed by taking the contradictory of the consequent as the antecedent of the premiss, and the antecedent as the

consequent of the inference with the contrariety of quality; as from 'If A is B, C is not D' is deduced in some cases,' ' if 'C is D, A is not B.'

According to the older method of contraposition, the premiss is first to be permuted, then to be taken its converse; as from 'All animals are mortal' is deduced the obverse, ' No animals are not-mortal,' and taking the converse of the obverse, we have 'No not-mortals are animals.'

In addition to the five processes of reduction of propositions from one form to another, other two may be noticed and these will not be of less worth than the preceding ones.

4.—Subalternation is the process by which is inferred a particular from a universal or a universal from a particular.

The two instances of subalternation:—

(a.)—The truth of I, and of O is deducible from the truth of A, and of E respectively.

This is evident from the fact that, particular propositions are contained in the universal ones.

(b.)—The falsity of A, and of E is deducible from the falsity of I.

This is shown at once to be true from the fact that a whole cannot be false, when a part is true.

5.—It has been seen in the diagramic representation of the rotation of the four classes of propositions

in order of their relation, that oppositions are of three kinds; viz., A and O, E and I are contradictory opposites; A and E, and I and O are respectively contrary and subcontrary opposites. *From the relations of opposition among the four classes of propositions in quality or quantity or both, we can show the truth, falsity, or obscurity of the one in relation to another.*

The results of inferences of these opposites are given below :—

I.	From the truth of A is deduced the falsity of O.
II.	,,	,,	E	,,	,,	I.
III.	,,	,,	I	,,	,,	E.
IV.	,,	,,	O	,,	,,	A.
V.	From the falsity of A is deduced the truth of O.
VI.	,,	,,	E	,,	,,	I.
VII.	,,	,,	I	,,	,,	E.
VIII.	,,	,,	O	,,	,,	A.

From the results already come to, three important rules can be established.

(a.)—Of any two contradictories, one must be true and the other false.

(b).—Of any two contraries, one or both may be false, as the case may be.

(c).—Of any two sub-contraries, both cannot be false ; one must be true, and both may be true.

6.—*Reduction of modality or modal consequence is a process in which simply, by a change in the degree of belief, or modality of a given proposition, an inference is drawn.*

> (*a.*)—General affirmative or problematic propositions are deducible from the corresponding necessary ones ; as from 'The man must be perfect,' are 'The man is perfect,' 'The man may be perfect.'

> (*b*).—The untenability of a necessary and assertory, is deducible from that of a corresponding problematic, but not conversely, the former from the latter. 'Man must be perfect' is untenable, when 'Man may be perfect,' is untenable. But 'It may rain' is not untenable, when ' It must rain ' is tenable.

7. From the relation of propositions, conditional or hypothetical, and categorical or unconditional, another reduction or mode of immediate inference, is possible, *viz.*, from categorical to hypothetical, from hypothetical to categorical, disjunctive to hypothetical, and hypothetical to disjunctive.

EXAMPLES.—

I.—' All A is B,' deducible to ' If A is, B is.'

II.—'If A is, B is,' is deducible to ' Every case of the existence of A is that of B.'

·III—The disjunctive 'A is either B or C', is deducible according to Ueberweg to one or other of the following hypotheticals :—

(A).—When A is a singular term,
(m).—If A is B, A is not C.
(n).—If A is C, A is not B.
(p).—If A is not B, A is C.
(q).—If A is not C, A is B.

Mill differs from Ueberweg in accepting the last two of the above inferences as true. The point of difference between both the logicians is best stated by saying that of the two propositions, 'A is B' and ' A is C,' standing in relation of opposition to each other, Ueberweg holds that from the falsity of the one follows the truth of the other; and *vice versa*, whereas Mill holds that from the falsity of the one, we come to the truth of the other, but not *vice versa*. According to the former logician the opposition between the constituents of a disjunctive proposition is one of contradiction, but not so according to the latter. To Mill the opposition is one of contrariety.

If the opposition between 'A is B' and 'A is C' be one of total exclusion, the forms of inference of Ueberweg would be necessitated. But if it be one of total exclusion, and be a contrary or a sub-contrary one, Mill's suggestions would be quite reasonable. The reasons for both of these important

logicians vary from each other in this point are not unimportant.

From the four or two hypotheticals may again be inferred the original disjunctive, as from the examples given below :—

(*m*).—If A is B, A is not C.

(*n*).—If A is not B, A is C.

(*p*).—If A is C, A is not B.

(*q*).—If A is not C, A is B.

By combining (*m*) and (*n*) and again (*p*) and (*q*) by the law of contradiction and of the Excluded Middle, and again combining the two products, we infer the disjunctive proposition ' All A is either B or C.'

From the two hypotheticals in Mill's sense, as will be seen below, the original disjunctive may also be inferred.

(*m*).—If A is not C, A is B (*n*). If A is B, A is C. Of the two ' A is B' and ' A is C'; the falsity of the one involves the truth of the other, hence they are the two members of a disjunctive proposition, *viz.*, 'A is either B or C.'

In the sense taken by Ueberweg, it is not possible to infer a disjunctive from a single hypothetical, but from Mill's sense, it is possible. From the hypothetical, 'If A is B, A is C,' we can by contraposition get a negative hypothetical. They are shown

at once to be the members of the disjunctive proposition, 'Either A is not B, or A is C.' Ueberweg, of course, holds it that this is untenable.

Each universal proposition, whether affirmative or negative, can have eight forms possible. Particular affirmative and negative, both can have four forms of each. Thus we have the twenty-four propositions of A, E, I and O.

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CHAPTER III.

OF SYLLOGISM.

The student has been already familiar with the fact that, an inference in a Deductive Reasoning must, in all cases, be less general than the premises; whereas in an Inductive Reasoning it is more general than the premises. A syllogism is a necessary inference of a proposition from two other propositions. It differs from an Immediate Inference in being drawn from two propositions and consisting of three altogether.

The Predicate of the conclusion, always in the first of the two given propositions, is called the *major term*; the subject of the conclusion, always in the second of the two given propositions, is *the minor term*; and the term taken as the medium, or means of comparison of *the major*, and *the minor terms*, is

the middle term. The propositions in which the major
and the minor terms are used, are called *the major,
and the minor premises*. The conclusion drawn from
the two data of conjoint premises is valid, as long
as the data are not proved false or untenable. A
syllogism may consist of two propositions, both un-
conditional or categorical, both conditional or hypo-
thetical or one hypothetical, and another categorical
or disjunctive, as the case may be. When the con-
clusion is drawn from the two uniform premises, the
syllogism is Unmixed ; when it is from one categoric-
al and another either hypothetical or disjunctive, it
is Mixed. Unmixed syllogisms have been stated to
consist of premises both categorical or both condi-
tional or disjunctive. In the former case the syllogism
is categorical ; as, ' All men are religious animals.'
' All reasoning beings are men,' therefore ' All reason-
ing beings are religious animals.' Certain rules to
which syllogisms, to be free from fallacies, must con-
form are called *syllogistic* ; they are as follows :—

(1.)—*Every syllogism can contain three terms only* ;
for, if it consists of less than three terms, the inference
is an immedeate one, and if more, it is really a com-
bination of more than one syllogism. It is, therefore,
clear that, a syllogism cannot contain more than three
propositions.

(2).—*The middle term must be distributed at least
once* ; for in both the premises, if both the terms be

taken in their partial extent, the middle term cannot
serve as a means for the comparison of the two, the
extents taken being likely in every case to differ
from each other; as, 'All cats are animals,' 'All dogs
are animals,' therefore, ' All dogs are cats.'

(3.)—*No term which was not distributed in the
premises is distributed in the conclusion.* To violate
the rule would be an inference of a general from
a particular.

(4.)—*Nothing can be inferred from two negative
premises.* No connexion between the terms in the
conclusion can be possible, when in the premises, it
has been shown that, both of them cannot have any
relation whatever with the middle.

(5.)—*If one premiss be negative, the conclusion
must be negative,* and *vice-versa, i. c., if the conclusion
be negative, one of the premises must be negative.*
There cannot be any affirmative relation, or connec-
tion between the major and the minor terms, when in
the premises, one of them has been shown to bear
affirmative relation with the middle, and the other
negative relation. The latter part is evident from
the fact that no negative relation between the major
and the minor could at all be established, unless the
relation between the middle term and either of the
major or the minor were not negative.

(6.)—From the above rule, it will be clear that,

*no affirmative conclusion can be drawn from premises
both of which are not affirmative ;* and similarly, *if
both the premises be affirmative, the conclusion must
also be affirmative.*

*(7.)—No conclusion can be drawn from two parti-
cular premises.* For granting the opposite to be true,
from the two affirmative premises, in which the
middle is undistributed, but there *cannot* be any con-
clusion ; and when one is affirmative and the other
negative, it is seen that a term undistributed in the
premises, comes to the distributed in the conclusion,
the case of two negatives being untenable from rule
(4).

*(8.)—If one of the premises be particular, the con-
clusion must be particular.* For if both be affirmat-
ive, *viz.,* A, and I., the conclusion cannot but be I ;
if one of them be negative, as in O., and A., and in I.
and E, in either case, there must be two terms to be
distributed in the premises, one of which must be the
middle. The conclusion must in either case be O,
there being a negative premise in both the syllogisms.

(9.)—No universal conclusion, it has been clear
from rule 8, *can be drawn from the two premises
both of which are not universal.*

MOODS.

The different arrangements of propositions from
the difference in the quality and quantity of the two

premises. are called the moods. There can be sixty-
four possible moods by combinations, such as, A. A.
A., A. A. I., &c.

FIGURES.

The difference in the forms of syllogism according
to the difference in the position of the middle term,
gives rise to the different figures. Some logicians
take the figures to be three, others four in number.
Taking B to be the middle term, and A. and B, to
be the major and the minor terms they can be
symbolically represented as follows :—

1ST CLASS.	2ND CLASS.	3RD CLASS.
I.—B A	A B	A B.
C A	C B	B C,
∴ CA or AC	∴CA or AC	∴CA or AC.

According to the general acceptation.

1ST.	2ND.	3RD.	4TH.
II.—BA	AB	BA	AB.
CB	CB	BC	BC.
∴CA	∴CA	∴CA	∴CA.

Possible moods are sixty-four in number; and of
the sixty-four, sixteen combinations are possible in
each figure. Of the sixteen, AA, AE, AI, AO, EA,
EE, EI, EO, IA, IE, II, IO, AO, OE, OI, and OO;
in the first figure, nine, *viz.*, AA, AE, AI, AO, EA,
EI, IA, IE, and OA, appear to be the valid forms of

syllcgism, but when actually examined, we have the following result :—

1.—From A and A.

A.—All men are rational beings.
A.—All philosophers are men.
∴A.—All philosophers are rational beings.

2.—Similarly examining A and E., no conclusion is to be drawn.

3.—From AI, is drawn I.

4.—From OA, is drawn no conclusion.

5.—From EA, is diawn E.

6.—From EI, is drawn O.

7.—From IA, is drawn no conclusion.

8.—From IE, is drawn no conclusion.

9.—From OA, is drawn no conclusion.

The four AAA, AII, EAE, EIO, are really the valid moods in the first figure.

An examination of the moods of the second figure will show the number valid.

1.— rom AA, All men are animals.

All birds are animals.

No conclusion; the middle term here in both the premises being undistributed.

2.—From AE, is E.

    A.   All squares are equilateral and equiangular quadrilateral figures.

    E.   No trapezium is an equilateral and equiangular quadrilateral.

    E.   No trapezium is a square.

3.—From AI, nothing can be drawn.

4.—From AO, is drawn O.

5.—From EA, is drawn E.

6.—From EO, is drawn O.

7.—From IA, is drawn no conclusion.

8.—From IE, is drawn no conclusion.

9.—From OA, is drawn no conclusion.

In the second figure, therefore, of the nine, four only, *viz.*, EAE, AEE, EIO, and AOO are valid.

An examination of the moods of the third figure can show which of the nine are valid.

1.—From AA, can be drawn I ; as.—

    All successful men are persevering minds.

    All successful men are intelligent.

    Some intelligent men are persevering minds.

2.—From AE, no conclusion.

3.—From AI, the conclusion is I,

4.—From AO, no conclusion.

5.—From EA, the conclusion is O.

6.—From EI, no conclusion.

7.—From IA, the conclusion is I.

8.—From IE, no conclusion.

9.—From OA, the conclusion is O.

Just in the same way, it can be shown, that AAI, AEE, EAO, EIO, and IAI, are the only valid moods in the fourth figure.

From a comparison of the valid moods, we can establish the following special rules :—

I.—From figure 1.

    1.—The major premiss must invariably be universal.

    2.—The minor premiss must invariably be affirmative.

II.—From figure 2.

    1.—The minor *major* premiss must be universal.

    2.—One of the premises must be negative.

    3.—The conclusion must be negative.

III.—From figure 3.

    1.—The minor premiss must be affirmative.

    2.—The conclusion must be particular.

    3.—The major premiss is affirmative, the minor is universal.

IV.—From figure 4.

> 1.—When the major is affirmative, the
> minor premiss is universal.
>
> 2.—When the minor premiss is affirmative,
> the conclusion is particular.
>
> 3.—When one of the premises is negative,
> the major premiss must be uni-
> versal.

Each one of these can be proved from the general
syllogistic rules and reasons for taking each to be valid
is given below:—

1. If the minor premiss be negative, the major
must be affirmative, and the conclusion negative. Here
the major term must be distributed in the conclusion,
although it has not been distributed in the premiss.
The minor premiss cannot, therefore, be affirmative, it
must be negative.

2. If the major be particular, the middle term,
being the predicate of the universal affirmative, must
be undistributed in both the premises, there can be
no conclusion. The major is not then particular, it is
universal.

II. —All the cases, *viz.*, 1, 2, and 3.

The case of one of the premises not being negative,
· would give rise to a case of the undistributed middle.
This justifies the second assertion, that either of the

premises must be negative, the conclusion must be negative; the major term must be distributed; and the major premiss having for its subject the major term must be universal.

III.—1, & 2. If the major premiss be negative, the conclusion is negative, the negative conclusion gives rise to a distributed major; but because the major is not distributed in the premises, it cannot be so in the conclusion. The minor cannot be negative, it is affirmative.

3.—The case of the conclusion being universal gives rise to a case of the distributed minor; but the minor beingthe predicate of an affirmative is undistributed. The conclusion, therefore, is not universal, it must be particular.

IV.—1. If the minor be particular, the predicate of an affirmative premiss being in every case undistributed, would involve a case of the non-distribution of the middle in both the premises, which cannot justify any conclusion; hence the minor cannot be particular, it must be universal.

2.—If the conclusion be universal, the minor term which is the subject of the conclusion, must be distributed; the distribution of the minor term in the premises cannot be possible, unless the proposition be negative.

3.—If the major premiss be particular, in case of the minor being universal negative, the major undis-

tributed in the premiss would be distributed in the conclusion; in case of its being particular negative, it would involve the unjustifiability of a conclusion from the two particular premises.

We have seen that of the sixteen moods of the first figure, the four; *viz.*, AA, AI, EA, and EI, are valid. This has been established directly from the syllogistic rules. Aristotle's *Dictum de cmni et nello,*—' Whatever is predicated of a term affirmatively or negatively, may be predicated in like manner of anything contained in it ;' can in fact be analysed into two, the one universal affirmative or negative, or another negative. An application of the negative to the sixteen moods in the first figure, excludes eight of them, *viz.*, AE, AO, EE, OE, IE, IO, OE, and OO, and an application of the affirmative serves to exclude another four, *viz.*, IA, II, OA, and OI, the four remaining are valid moods. Because the Dictum is applicable to the first figure only, it is considered perfect, aud the others to which it is not applicable are the imperfect. The following mnemonic lines will help the student to remember systematically all the valid moods in each figure, which we have already shown to be deduced from the syllogistic rules:—

*(Barbara, celarent, darii, ferioque,)*prioris.
Cesare, camestres, festino) baroko, secondæ.
Tertia, *daraptia, disamis, datisi)felapton.*

Bokardo, ferison, habet; quarta, insuper-addit,
Bramantip, camenes, diramis, fesapo, fresison.

From these lines, we can, without any difficulty, re-
member, that the first figure has four, the second four,
the third six, and the fourth five valid moods. The
imperfect moods of Aristotle's can be reduced to the
perfect, *i. e.*, of the second, third and fourth figure, to
those of the first figure. The reduction can be direct
and ostensive, and *Indirect* or *Reductio per deduc-
tionem impossibile.* The *Ostensive Reduction* consists
in employing one or more of the processes of the con-
version, permutation, and transposition of premises.
The Reductio per Impossibile consists in showing by
the perfect mood and the laws of opposition, that the
contradictory of the conclusion is false, and therefore
the conclusion must be true. In the mnemonic lines
b, c, d, f—show which of the moods of the second, third,
and fourth figures are to be reduced, and which ot the
moods to correspond with those of the first figure; as,
when *Baroko* is reduced, it must be made to corres-
pond with *Barbara.* The letter *s* when occurring
after a vowel shows, that the proposition represented
by the vowel is to be converted simply; the letter *p*
shows, it is to be converted *per accidens.* The letter
m shows, the premises are to be transposed ; *k* the
proposition to be reduced *per impossibile.* The
letter *k* shows, that the mood containing it, was
reduced by the older. logicians by the Indirect

Method. The small letters are literally meaningless, for example, take *Festino* of the second figure ; it can be without any change reduced in *Ferio* of the first figure. *Camestres* of the second to the *Celarent* of the first. Take the latter case :—

    A.   All men are animals.

    E.   No stones are animals.

    E.   No stones are men.

The letter *m* indicates the transposition of the premises, accordingly, by making the minor major, and converting simply, we get the perfect mood *Celarent.*

    E.   No stones are animals.

    A.   All men are animals.

    E.   No men are stones.

Cesare in the same way to *Celarent*, and *Baroko* to *Barbara.* *Baroko* and *Bokardo* can be reduced to the first figure in a twofold way ; first, the former into *Ferio*, and then the latter into *Darii.*

    Examples :—

        A.—All men are rational animals.

        O.—Some creatures are not rational animals.

        O.—Some creatures are not men.

By the contraposition of the major premiss, and obversion of the minor, we have the following :—

        E.—Rational animals are men.

        1.—Some creatures are not men.

      ∴ I.—Some creatures are not rational animals.

Bokardo into Darii.

> O.—Some human beings are not foolish.
>
> A.—All human beings are rational.
>
> ∴ O.—Some rational creatures are not foolish.

By contraposition of the major, and transposition of the minor premiss, we have the following:—

> A.—All human beings are rational creatures.
>
> I.—Some human beings are not foolish.
>
> ∴ I.—Some not-foolish creatures are rational.

These two, *viz.*, *Baroko* and *Bokardo* can again be reduced to *Barbara* of the first figure by *Reductio per Impossibile.*

Baroko of the second figure:—

> A.—All A is B.
>
> O.—Some C is not B.
>
> ∴ O.—Some C is not A.

This conclusion must be true; for if not, the contradictory, 'All A is C' must be true. Now combining these with the major premiss, we have the syllogism in the perfect mood *Babara.*

> All A is B.
>
> All C is A.
>
> ∴ All C is B.

If the conclusion is true, its contradictory must be false by opposition, since two contradictory propositions cannot be false. But the contradictory is the

minor premiss of the former syllogism, it is, therefore, true; and is true only in supposition. The conclusion of the syllogism is, therefore, true; its contradictory must be false; and the falsity is either of the premises, or of the process. Because it is owing to the mood Barbara of the first figure, that the process cannot be false, the falsity must be confined to the premises, and that to the minor premiss. 'All C is A' must be false; its contradictory, some 'C is not A' is, therefore, true, and this is the conclusion of the original proposition. Exactly in the same way, the conclusion O, 'Some C is not A' can be drawn from 'A,' 'All B is C.'

Darapti and *Felapton* of the third figure are converted *per accidens* into *Darii* and *Ferio* of the first.

Of *Bramantip*, *Dimaris*, and *Fresison* of the fourth figure, the first and second by transposition of the premises and the third by simple conversion, are reduced respectively to *Barbara*, *Darii*, and *Ferio* of the first figure. *Cesari* of the second figure, and *Darapti* of the third figure, although of imperfect mood, can by the Indirect Method be proved true.

DIFFERENT KINDS OF SYLLOGISMS.

1.—Syllogisms vary according to *Quality and Quantity*, and therefore, for moods.

2.—They vary according to *Relation*; and they are classified as Pure, and Mixed syllogisms.

3.—They vary according to the various degrees of belief, *i. e.*, according to modality.

Unmixed syllogisms, we have seen already, consists of uniform propositions either *Categorical or Hypothetical.*

Mixed syllogisms may consist of *Hypothetical* and *Categorical* ; *Disjunctive and Categorical* ; and *Conjunctive and Disjunctive* propositions.

It is enough for the student to remember that, in the unmixed hypothetical syllogism or syllogisms, containing some hypothetical premiss, that 1.—antecedents of *hypothetical propositions are to be taken for the subject, and the consequents for the predicate of the whole; 2—the quantity of the antecedent and the quality of the consequent are to be the quantity and quality of the whole.* Take a general instance of an hypothetical syllogism from the third figure, Cesare:—

> In all cases, if C is, B is not.
>
> In all cases, if A is, B is.
>
> In all cases, if A is, C is not.

Of the mixed syllogisms, hypothetico-categorical is the most ordinary form. It consists of an *hypothetical* as the *major* and *categorical* as the *minor* premiss. There can be two rules for the inference in this form.

1.—If you affirm the antecedent, you affirm the consequent, but not *vice-versa.*

2.—If you deny the consequent, you deny the antecedent, but not *vice-versa*.

The hypothetico-categorical syllogisms, according to the first rule are, 1.—*Constructive*, and those according to the second rule are 2.—*Destructive*.

Examples:—

1.—In all cases, if A is, B is ⎫
⎬ Constructive.
B is ⎪
∴ A is ⎭

2.—In all cases, if A is, B is ⎫
⎬ Destructive.
B is not ⎪
∴ A is not ⎭

Hypotheticals can have categorical forms:—

1.—Every case of the truth of A, is case of the truth of B.

This is a case of the truth of B.

This is a case of the truth of A.

Every instance of a mixed syllogism, consisting of an hypothetical and a categorical, can have its hypothetical form.

In every case if A is, B is.
If this case is, B is.
If this case is, A is.

Every disjunctive categorical syllogism, which some logicians call a mere disjunctive syllogism, consists of the major-premiss disjunctive, and the minor

premiss categorical, as in the mood Barbara of the first figure.

> X is either M or N.
> Y is X.
> Y is either M or N.

But in as much as every disjunctive proposition can be dissolved into two hypothetical propositions, one of them serve to form the minor premiss; as—

1.—A is either B or C., or 2.—A is either B or C.
   A is not B.   A is B.
  ∴ A is C.   ∴ A is not C.

A Disjunctive-Categorical syllogism may easily be changed into *an hypothetical categorical one* as in the following example:—

From A is either B or C.
   A is B.
  ∴ A is not C.

We have—

> In all cases, if A is not B, A is C.
> In this case A is B.
> ∴ A. is not C.

DILEMMA.

A combination of a conjunctive and a disjunctive proposition in a syllogism is a case of a dilemma. There can be four forms of conjunctive propositions according as the terms joined together by the

copulative and remotive particles, are conditional or
categorical. Dilemma thus comprehends any case of
the conjunctive premiss; it may be either copulative
or remotive. This is, therefore, a wider sense of the
dilemma. In its narrower sense, it may be an
hypothetical disjunctive syllogism. The last is a
view entertained only by a few logicians.

According to Ueberweg, it is an inference, in
which, provided that, ' any of the members of the
disjunctive may be true, the same conclusion results.'
The opponent here finds it too difficult to extricate
himself from the danger of being led therein for his
conclusion, whichever datum he chooses.

Examples of the Dilemma when it is an hypothe-
tical-disjunctive and a remotive premiss.—

1.—A combination of an hypothetical-disjunct-
ive and a remotive premiss.

> If A is M, either B is N or C is N.
> Neither B is N nor C is N.
> ∴ A is not M.

2.—A combination of an hypothetical remotive
and an hypothetical disjunctive.—

> If A·is M, neither B is nor C is N.
> If D is Q, either B or C is N.
> ∴ If D is Q, A is not M.

3.—A combination of an hypothetical disjunctive, and an hypothetical remotive differing from the example, 1.—the position of the premises iu relation to the major and the minor —

> If A is M, either B or C is N.
> If D is Q, neither B or C is N.
> ∴ If D is Q, A is not M.

Each of these premises can be broken up into their equivalent components. This can be illustrated from example, 1.—

The major premiss can be thus analysed into—

> (a). If A is M, B is N.
> (b). If A is N, C is N.

The minor premiss can be thus analysed into—

> (a). B is not N.
> (b). C is not N.

Taking (a) of the major with (b) of the minor we have—

> If A is M, B is N.
>> B is not N.
> ∴ A is not M.

Taking (b) of both, we have—

> If A is M, C is N.
>> C is not N.
> ∴ A is not M.

Therefore, whichever condition or truth the opponent chooses, it must lead him to the same definite conclusion, of which the instance here is ' A is. not M.'

EXAMPLES OF DILEMMA.

In its wider sense.

(1). A combination of a categorical disjunctive. and a remotive.—

A is either B or C.

D is neither B nor C.

∴ D is not A.

Transposition of the premises gives the same. conclusion.

(2). A combination of an hypothetical remotive. and a categorical disjunctive.—

If A is M, neither B nor C is N.

Either B or C is N.

∴ A is not M.

(3). A combination of a copulative and a disjunctive.—

A as well as B is C.

D is neither B nor C.

∴ D is not A.

(4). A combination of an hypothetical cumulative and an hypothetical disjunctive.

If A is M, as well as B is M, C. is N.

If D is Q, either A or B is M.

∴ If D is Q, C is N.

A combination of an hypothetical remotive and an hypothetical disjunctive.

If A is M, as well as B. is M, C is N.
If D is Q, either A or B is M.
∴ If D is Q, C is N.

A combination of a remotive and a categorical disjunctive, that of an hypothetical remotive and an hypothetical disjunctive, and that of an hypothetical remotive and disjunctive we can similarly have of the first figure.

It must be borne in mind by the student, that when examining a syllogism either mixed or unmixed or a case of the Dilemma, it must be according to one of the figures, and corresponding to some of the valid moods of the figure.

ENTHYMEMES.

An enthymeme, in its original sense, would mean a probable reasoning, or a syllogism with probable premises. But 'the sense in which the term is now used differs vastly from the original. It may be defined to be a suppressed form of syllogism or a syllogism of which one of the premises is omitted in language. In the example 'Iron gravitates, because it has weight,' we find an instance of this kind. The major premise here is not expressed

in language. The syllogism when properly arranged stands thus—

> Every body that has weight gravitates.
> This body has weight.
> ∴ This body gravitates.

In the converzione of men of taste and education, we find very often instances, one of which is here pointed out.

Enthymemes originate from the suppression of one of the premises, or that of the conclusion. Bearing in mind that the major premiss is formed of the major and the middle terms ; the minor premiss, of the minor and the middle terms; and the conclusion, of the major and minor terms, we can make out any part of a syllogism, when suppressed.

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CHAPTER IV.

Trains of Syllogistic Reasoning.

From Syllogisms, when combined together, a single conclusion is arrived at ; and the combination is called a *Train of Reasoning*.

Two peculiarities are to be noticed in all such trains ; when in a train, a syllogism justifies the premiss of a subsequent syllogism it is in reference to the subsequent one, (1.) a *Prosyllogism* ; and

when the subsequent one is taken in reference to the one preceding it is (2). an *Epysyllogism.*

> *a.*—All A is B
> All B is C
> ∴ All A is C
> *b.*—All A is C
> All C is D
> ∴ All A is D
> *c.*—All A is D
> All D is E
> ∴ All A is E

The first syllogism with reference to the second is a *prosyllogism,* and second with reference to the first is an *episyllogism.*

The form of the whole train is Progressive, Synthetic or Episyllogistic. Such Synthetic, Progressive, or Episyllogistic train compressed, *i.e.*, with all the conclusions except the last suppressed, is called Sorites, the above train compressed into a Sorites will be:—

> All A is B
> All B is C
> All C is D
> All D is E
> ∴ All A is E

The converse of the above train, a train in which we advance from an episyllogism to a prosyllogism, is called Analytic.

· A Progressive train is episyllogistic. The Analytic method is used in Deductive Logic. The Synthetical or Progressive is used in the demonstration of the proposition of Euclid. An example of the latter form is given below:—

A suppression of the conclusions except the last, and therefore of all the major premises except the first one, is another form of Sorites, called Goclenian, and it stands thus:—

a.—All B is C	All B is C
All A is B	All A is B
∴ All A is C	All D is A
b.—All A is C	All E is D
All D is A	∴ All E is C
∴ All D is C	
e.—All D is C	
All E is D	
∴ All E is C	

The first form of the Sorites is called the Aristotelian Sorites.

Besides the two forms of the suppressed train, another prosyllogistic, analytical, or regressive train, with some of the premises not expressed in language, is called *Epicheirema*.

An example of the above,—

All poets are men of imagination, all musical minds are poets, because all musical minds are the

sources of attraction; therefore all musical minds are
men of imagination. The whole of it can be fully
expressed in two syllogisms.

> All poets are men of imagination.
>
> All musical minds are poets.
>
> ∴. All musical minds are men of imagination.

For, 'all musical minds are sweet' the reason
given is, 'All musical minds are the sources of attrac-
tion,' the major premiss here being suppressed it is
an enthymeme.   The full form of the syllogism is.--

> All the sources of attraction are sweet.
>
> All musical minds are the sources of attrac-
> tion.
>
> ∴. All musical minds are sweet.

The whole theory can be summed up by remind-
ing the student that, Trains of Reasoning can either be
Synthetic, Progressive, Episyllogistic ; or Analytic,
Regressive, or Prosyllogistic. In both the cases,
syllogisms can be fully expressed, or a part of them
can be suppressed. In the former case, when sup-
pressed, it gives rise to the two classes of Sorites; viz.,
the Aristotelian, the Goclenian, in the latter case
when suppressed, it is an epicheirema, and an epi-
cheirema can be simple with reasons for one premiss
only, double with reasons for both the premises, and
complex with reasons for reasons. The Sorites,
similarly to syllogisms, can be according to the
different figures in the different moods.

——o——

FALLACIES.

A fallacy is a violation of a rule of reasoning; in other words, it is a defective reasoning. Fallacies are Inductive and Deductive according as the violations of the canons of reasoning are Inductive or Deductive. Since immedeate and medeate inferences can both be deductive, the fallacies can both be Immedeate and Medeate. The annexed division of the fallacy of deduction will help the student in remembering, as far accurately as possible, the different kinds of logical errors. The table of the division of fallacies will show the number included under the head Immedeate. Medeate Fallacies include what is called syllogistic and non-syllogistic, and non-syllogistic can be examplified by the fallacies arising from the violation of the mathematical axioms. Among the logical fallacies themselves, those under the head of semi-logical are non-inferential, and can be both of Deduction as well as of Induction. We are concerned with those of deduction, and they are of division, of definition, and of ambiguous middle &c.

Fallacies of definitions are:—*a*.—Description, accidental or Redundant definition *b*.—Too limited or too wide definition, *c*.—Definition by synonym, *d*.—Obscure, figurative and ambiguous definition, *e*.—Negative definition.

Fallacies of Divisions are these—

Of *a.*—Physical partition or metaphysical analysis, *b.*—Cross division, *c.*—Incomplete or over complete division, *d.*—Overlapping division. The mathematical or non-logical fallacies are as the table will show.

Fallacies already made mention of, are Logical ones. There are others called *Material Fallacies*, which arise either from (1) *Premiss unduly assumed*, (2) and which arises from irrevelant conclusion consisting in appealing to the feelings, and prejudices of people. The latter class of Material Fallacies are called *Ignoratio Elenchi*.

An enumeration of the different fallacies will be advantageously made by the student from what is given in the tabular view annexed. Explanations of all the fallacies enumerated are not necessary to be given. It will be enough for the student, for the present, to be familiar with those he generally comes across.

Of all the fallacies of Immedeate Inference, those of Conversion, Permutation, Contraposition, and Opposition are of frequent occurrence and importance.

The Fallacy of Conversion arises from the neglect of the fact that, the Subject and Predicate of equal quantity only are capable of having their position interchanged. For instance, you convert 'All men are animals' into 'All animals are men.' After you have converted it to the present form, you will have to take the process of subalternation to make the inference a particular one. Its inference is 'Some animals are men.'

The Fallacies of Permutation or Obversion, or of Æquipolence as they are called, arise from the neglect of the truth, that in Deductive Logic, the actual quantitative relation between the Subject and the Predicate of a proposition must be invariable; as from ' All men are rational beings,' we cannot infer 'All men are not rational beings.' But the true inference will be ' No man is not a rational being.'

The Fallacies of Contraposition also arise from an overlooking of the relation of the distribution of terms. From 'No man is supernatural,' you cannot infer—'All not-supernatural beings are men.' The true inference is 'No supernatural being is man.'

The Fallacies of Opposition arise from mistaking the truth of a negative from the corresponding affirmative.

From the falsity of 'All men are useful members of society,' you cannot infer—'No man is a useful member of society.'

Another class of fallacies arises from the violation of the syllogistic rules. But inasmuch as every syllogistic rule is, in some way or other, based on the Fundamental Principles, these fallacies are ultimately a breach of them. These fallacies can be enumerated under five different heads. (1) Of four terms ; (2) of four premises ; (3) of undistributed middle ; (4) of Illicit Process of the major and minor and (5) of Negative Premises. All other fallacies under the head of the syllogistic Inferences can be identified with one of the above mentioned. (1) and (2) arise from a violation of the first of the general syllogistic rules ; (3) arises from the violation of the third ; and (5) arises from the breach of the fourth.

The most important of all the fallacies of the above heads are those of ambiguous middle ; and

it is often very difficult to recognise these. To facilitate detection of fallacies of this head some four circumstances may well be remembered:

(1). When connexion between the two meanings of a term is hardly to be perceived, and when perceived at all, it is only byaccident

(2). In terms in which we have got to distinguish between the first and the second intention of the speaker. The farmer means by *beast* something not commonly understood by the naturalist. *Bird* means to the sportsman nothing but a *partridge.*

(3). When words carry more than one meaning because of two or more things being connected by resemblance or analogy; *sweet,* for instance, refers primarily to taste, but secondarily to sound, &c., &c.

(4). When several things bear the same name because of their being connected by vicinity of time and place, and, therefore, of cause and effect. This can be illustrated by taking a common instance of the term smell: 'The rose smells sweet'; and 'I smell the rose.'

The tabular view of division shows, that the fallacies of Composition, Division and Accidens are to be placed under the general head of the semi-logical, arising from an ambiguous sense of the middle term and having for their origin the context.

a.—Fallacy of Composition is the taking of the

middle term distributively in the major premiss
and collectively in the minor premiss.

> b.—Fallacy of Division is a case of the middle
> taken collectively in the major and distri-
> butively in the minor.

> c.—Fallacy of Accidens arises from taking a term
> simply, or without any condition in one
> premiss, or as modified by certain accident
> in the other.

Fallacies of Accidens have three special cases :—

(a) from a simple statement to a conditional
one ; (b) from a conditional to a simple state-
ment. The former is *Fallacia a dicto simpli-
citer ad dictum simpliciter;* and (c) from one
conditional statement to another.

Examples :—

Of Composition :—(a) " I can afford to buy the
books ; I can afford to buy these pictures ; I can
afford to buy statuettes. The books, the pictures, the
statuettes are all that I at present wish to pur-
chase. I can, therefore, buy everything that I wish
to buy." Of Division (b) " Five is one number ;
three and two are five ; therefore three and two
are one number."

Of Accidens (c) " What is brought in the
market is eaten ; Raw meat is brought in the
market ; Raw meat is eaten."

These three classes of fallacies have their origin
in the ambiquity of language, and that ambiquity
depends, in most cases, on the ambiquity of the
middle, and in very rare instances, on the ambiquity
of the major and minor terms.

Material Fallacies, although not belonging to De-
ductive Reasoning, have a great concern with it.
They can be generalised as follows:—(1) *Petitio
Principii*, (a) *Argument in a circle*, (b) *Begging the
question*, (2) *Falsity of Premises*, (3) *Ignoratio
Ilenchi.*

The two cases of the *Petitio Principii*, (a) *Argu-
ment in a circle*, and (b) *Begging the question* are
worth noticing, as they are of very frequent
occurrence—

(a). When one proposition is proved from an-
other and again when the other is proved from the
first; as, because A is B, B is A; again, because B is
A, A is B.

(b). When of the two syllogisms, the major pre-
miss of the first syllogism is proved by the second,
and the major premiss of the 2nd by the first
syllogism; as.

a.—B is A.	b.—C is A.
C is B.	B is A.
∴ C is A.	∴ B is C.

The name *Argument in a circle* is given to the
fallacy from the fact of its ending where it begins,

and *Begging the question* to the latter class of fallacy from the fact that it assumes one of the conclusions to be identical in meaning with or as a consequence of one of the premises. As an example of the last case :—

> All philosophers are rational beings.
> Rational beings are not irrational.
> ∴ No philosopher is irrational !

The falsity of the fallacy of premises arises from assuming something as cause of something else, when that assumed as cause is merely a sign or antecedent of it.

For *its* assumption of not cause as cause, it is called *Non-causa pro-causa ;* and *Post hoc ergo propter hoc,* or after this, and therefore caused by this. Instances of fallacies given by Whatley in his Elements are very important for the student. The two are quoted here to illustrate the cases of the *petitio principii,* the instances being used by all logicians of note. "If any one," he says, "should infer authenticity of a certain history from its recording such and such facts, the reality rests on the evidence of history." All other cases in which a Premiss (whether the expressed or the suppressed one) has no sufficient claim to be admitted, I shall designate as the value of the fallacy of undue assumption of a Premiss.

An example from the same Author for the *Argu-ment in a circle* :—" If any one argues that you ought to submit to the guidance of himself, or his leader, or his party, &c., because these maintain what is right; and then argues that what is so maintained is right, because it is maintained by persons, whom you ought to submit to, and these are himself and his party."

An example of *Non-causa pro causa*, in which an effect is taken for a cause:—" A great deal of money in a country is a pretty sure cause of its wealth ; and thence has often been regarded as a cause of it whereas in truth it is an effect."

The fallacies of *Ignoratio Ilenchi* are the errors of arguments not hitting the point. According to Whatley it is an apparent process of refutation of your opponent's statement ; for, he says " it is sub-stantially the same thing to prove what is not de-fined or to disprove what is not asserted." A barris-ter, for instance, on a mere assumption of the com-mission of an illegal act, will argue on and prove it to be one very highly punishable. Here, of course, proof is no proof. The fallacies under the head are (1) *Argumentum ad hominem,* (2) *Argumentum ad ver-acundiam,* (3) *Argumentum ad populum* ; and these are to be contradistinguished from *Argumentum ad rem.* (1), and (2) consist of appealing, the first, to the passions and prejudices of a single individual ; the

third, to the prejudices and feelings of the people; and the second consists of appealing "to our reverence for some respectable authority, some memorable institution."

Argumentum ad rem, or *ad judicum* has reference to the person addressed, and bears directly and absolutely·on the question.

" The fallacy of shifting ground, quite a different instance of *Ignoratio Ilenchi*, arises from one of the parties attempting in vain to maintain his position," and " shifting his ground as covertly as possible instead of honestly giving up the point," an instance of this as furnished by Whatley is to be found in the fact that, when in 1810, the University was charged with the neglect of mathematics, the authorities finding it rather impossible to repudiate the charge, had to make a show of argument against their irresponsible conduct, by saying that the University " was never famous for Mathematics."

To these may be added another two not of less ordinary occurrence :—

The fallacy of Non-sequitur arises from the conclusion, not in any way following from the premises.

The fallacy of many questions consists of assuming something regarding certain persons, or things by way of asking questions. Petitio Principii is not altogether without some importance to Deductive Logic.

Detecting fallacies should not be considered as depending on rules, but as a means whereby to engender such a habit of mind as will best fit us for practice. Logic "teaches us not how to find the Fallacy, but where to search for it," ou what principle to condemn it. Whatley begins his division with Fallacies into *In Dictione* or *Ex-Dictionem* i. e. those in words, and those in thought; and proceeds further in his course. Whatley's division differs very little from Aristotle's in so far at least as the outlines of both are concerned.

With reference to the detecting of fallacies Hobbes says: " Words are the counters of wise men, and the money of fools." Whatley supplements Hobbes with the remark that marking out fallacies is like the detection and apprehension of a criminal in spite of all his arts of concealment and disguise.

Ueberweg considers fallacies under three general heads: (1) fallacies into which one falls in the process of reasoning i. e. when deducing conclusion from the premises; (2) those in the premises; and (3) those in the conclusion.

Fallacies of the first head comprehend Paralogism, Sophism, and fallacies of induction in Inductive Reasoning.

An inference when incorrect in its formal relation aud leading the person reasoning into error is Para-

logism. If there is intention to deceive, it is Sophism.

Fallacies of the second head comprehend nothing but those of material truth. One of the most important of material fallacies is *Reasoning in a Circle*. Fallacies of the third head are those involving a divergence from what is deduced from the premises to what is to be proved or in substituting the latter for the former.

The divergence means proving too much or too little in quality or quantity.

The most important of fallacies, comprehended by this head, is that of *Ignoratio Ilenchi*.

CHAPTER VI.

Function and Value of Syllogism.

Syllogism is considered by Mill more as a process of interpreting a general proposition and applying it to particular cases than a type of reasoning. No syllogism, supposes Mill, ever leads to a new or unknown truth. It makes clear what the premises contain. It has been already indirectly stated that every syllogism involves a *petitio principii*. Take, for instance, the syllogism, ' All men are rational ; Plato is man; therefore Plato is rational.' When

'All men are rational' was known, and it was known that Plato was none but a man, it is not far from being known that Plato was rational. The conclusion, therefore, leads to what was already given in the major premises. This is, therefore, according to Mill, an instance of *petitio principii*. Syllogism is not of course a useless process. Its function is to interpret a general proposition, and to apply it, as has been already shown, to particular cases; and its value lies in testing the validity of reasonings.

John Stewart Mill has not been the only propounder of this theory of the value and functions of syllogism. Harschel, Whewell, Professor Bain, and many others have advocated it. Not that the upholders of this view have not had opponents. Mansel, DeMorgan, Martineau, and some others have strongly objected to it.

Mill does not consider syllogism capable of serving fully the purpose for which it is generally meant. His reason is two-fold : it is not the ordinary form of reasoning ; it involves the fallacy of *petitio principii*. We may, if we prefer, say much against Mr. Mill's view.

We admit that syllogism is not the ordinary form of reasoning. It is not the process according to which we do reason, but is assuredly the one, according to which we should reason. We test our reasoning by arranging it in the form of syllogism.

It does not involve, as Mill supposes, *petitio principii*. It leads us not to what we already know, but to something we require knowing. Human mind is not omniscient. Power of intellect in one varies from that in another. It admits of degrees.

One may see a particular truth from a general proposition from which it is derived without referring to syllogism ; whereas another may be incapable of doing so. To a person of extraordinarily powerful intellect syllogism may be of little consequence; but it is assuredly of considerable importance to men of ordinary intellectual powers. If this argument is not potent enough to obviate Mill's objection, another more easily to be seen can be here introduced. If the conclusion in a syllogism were to be drawn from one premiss or from two premises separately, we might look upon the process as involving the fallacy in question. But as in every case of a syllogism, conclusion is invariably drawn from the two premises conjointly, none can be considered as involving *petitio principii*.

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CHAPTER VII.

Probability and Probable Reasoning.

Probability shows, that degree of belief in certain questions is not full or complete, or the sign of the tak-

ing place of some event is not so manifest as to be taken for certain. Belief is subjective, and certainty from external circumstances is objective. It ordinarily means more "likely than not." As a degree of belief it can be represented by fractions, and can be seen to correspond exactly to the mathematical term chance. When, for instance, you say, 'He will probably pass this year,' the probability may either be $3:4$ or $1:4$, $\frac{3}{4}$ or $\frac{1}{4}$; the one, or the other may be either for, or against his passing.

As every probable proposition, according to Professor Venn, is proportional, given the one form, we can infer the other form of the same proposition. this is therefore an *Immedeate Inference.* Given that 3 in 4 in a college are Europeans or Eurasians, we may infer or draw an Immedeate Inference, that the probability of a student being in the college is $\frac{3}{4}$. Conversely, given the fraction or degree of probability, we can draw a corresponding proportional conclusion. A universal proposition is at once distinguished from a proportional proposition, by the fact that, in the former, the subject is a mere sub-class of the predicate, whereas in the latter, the relation between the two extremes is probable, and the probability may be expressed by a fraction, say $\frac{m}{n}$; the above, therefore, are the rules of Immedeate Inference.

The rules of Medeate Inference in *probability* may be either *formal* or *experimental.* The rules are formal

when they are deduced from probable proposition by the mere application of Arithmetic; the rules are experimental when they either depend on peculiar hypothesis, or demand for their establishment continually renewed appeals to experience, and extension by the aid of the various resources of Induction.

Formal rules for the two classes are quoted here from Venu's original.

(a) Rule for Exclusive Events.

" If the chances of two exclusive or incompatible events be respectively $\frac{1}{m}$ and $\frac{1}{n}$, the chance of the one or other of them happening will be $\frac{1}{m} + \frac{1}{n} = \frac{m+n}{mn}$." In cases of more than two events of the kind in question, we have to take the same way. " If the chance of one or other of the two incompatible events be $\frac{1}{m}$ and one alone be $\frac{1}{n}$, the chance of the remaining will be $\frac{1}{m} - \frac{1}{n} = \frac{n-m}{mn}$." For example, if the chance of a man's coming home from a distant place be $\frac{1}{9}$, and the chance of his coming by train be $\frac{1}{99}$, that of his coming by some other conveyance will be $\frac{1}{9} - \frac{1}{99} = \frac{11-1}{99} = \frac{10}{99}$.

(b). When the events are so connected together that, " one is contingent upon the occurrence of the other," the rule is that " if the chance of one event is $\frac{1}{m}$, and if it happens, another which will also hap-

pen is $\frac{1}{n}$, then the chance of the latter is $\frac{1}{mn}$; " In other words, the probability of the major premiss and that of minor multiplied gives the probability of the conclusion.

The Experimental rules of Medeate Inference differ from the above in respect of their cogency and freedom from appeal to experience or to hypothesis. The process of ascertaining the probability in such cases may be established thus :—" It the chance of a thing being p and q are respectively $\frac{1}{m}$ and $\frac{1}{n}$, the chance of its being not p and not q is $\frac{n-1}{mn}$, and the chance of its being not p and not q is $\frac{(m-1)\ (n-1)}{mn}$ where p and q are independent. The sum of these chances are obviously unity, and it ought to be, since one or other of the four alternatives must necessarily exist." For students more advanced one more quotation is given below :— " Let us take a batch of 1,200 as a sample of the whole. Now, from the data which were originally given to us, it will easily be seen that, in every such batch, there will be on the average 120 who have black hair, and therefore 1,080 who have not. And here in strict right, we ought to stop, at least until we have applied again to experience ; but do not stop here. From the data we assume, we go on to infer, that of 120,10, *i.e.*, ($\frac{1}{12}$ of 120) will be short-

sighted, and 110 will not. Similarly we infer of 1080 90 are short-sighted, and 990 are not. On the whole, then the 1,200 are thus divided ; black haired short-sighted, 10 ; short-sighted without black-hair, 90 ; black-haired men who are not short-sighted, 110 ; men who are not short-sighted, nor black haired. 990."

APPENDIX.

Notes Explanatory and quotations from different Authors.

Speaking of the importance of language to Logic, Whatley says,—" Logic is therefore the art of employing language properly for the purpose of reasoning and distinguishing what is properly and truly an argument from the spurious imitations of it."

Hamilton belongs to the class of Logicians advocating Logic from the subjective point of view. He defines Logic, as " the Science of the Laws of thought," and considers that, it can have no other definite aim than one; *viz.*, " thought by itself." " The Science of the formal laws of thought" is one among his typical definitions.

J. S. Mill is to be classed with material Logicians. His views of Logic differ from one of Hamilton's. In his " Examination of Hamilton's Philosophy," he recognizes the subjective view, not overlooking the objective reality. Here he defines Logic as " the art of thinking, which means of correct thinking, and the science of the conditions of correct thinking.',

Mill, like all other logicians of his class, does not hold it enough for Logic, if only the product of

thought is free from self-contradiction or irrelevancy
but must correspond with the reality of things. Like
Whatley he recognizes the importance of language
by adopting the phraseology of the third class of logi-
cians. To the class of Material Logicians belongs
Herbert Spencer also, since he takes the *a posteriori*
view of the science. Logic is to him the science of
the most general laws of correlation, which " contem-
plates in its propositions certain connexions predicat-
ed, which are necessarily involved with certain other
connexions given; regarding all these connexions as
existing in the *Non ago*, it may be not under the
form we know them, but in some form."

Ueberweg holds the process as well as the product
of perception to be of equal importance.

The British Logicians totally discard the recogni-
tion of intuition and its concerns.

Mill's definitions of the fundamental Principles:—

Of identity: — " Whatever is true in one form of
words, is true also in every other form of words,
which convey the same meaning."

Of contradiction: —" The affirmation or denial of
its contradictory are logical equivalents, which it is
allowable and indispensable to make use of, as
mutually convertible. " Of Excluded middle: —
" It is necessary to substitute for the denial of either
of two contradictory propositions, the assertion of the
other. "

Ueberweg combines the *Axiom of Contradiction* and that of *Excluded Middle* into what is called the Principle of *Contradictory Disjunction*.

On Terms.

Thomson means by conception, both the process and the product. His process of forming concepts involves (1)Comparison, (2) Reflection, (3) Abstraction, (4) Generalization, (5) Denomination. In Comparison, the student ought to distinguish between the process and the product; when it means the process, it is nothing more than (1) observation. In Reflection, we ascertain the points of agreement and disagreement, and this we can do by analysing a thing into its constituent attributes; the second step, therefore, in arriving at concepts, may be taken as (2) analysis. In Abstraction, we unify mentally what is found common to all the individuals compared; we can therefore assign another name to it, *viz.*,(3) *Mental Unification*. In the fourth step,*i.e.*, in Generalization we recognize things as belonging to a certain class; this is, of course, the product of (4) *Comparison*. In the last step, *i.e.*, in Denomination, we symbolize or name the aggregate of attributes. It can, therefore, be called (5) *Symbolization or naming*.

Adjectives according to Jevons and Mill are concrete and general, having denotation and connotation both. Whatley, Fowler, Martineau and others differ

from Mill, Jevons &c., by taking adjectives to be the names of attributes, the latter considering them as names of things implying attributes, concrete and general. There has been ever a disagreement among logicians, as to the reasonability of proper names not having any connotation. Quotations from Mill and Jevons for the signification or connotation of proper names, may help the student to understand how proper names can, in certain cases, have meaning.

Mill, on this point, says: —

"Whatever names given to objects convey information, that is, whatever properly has any meaning, the meaning resides in not what they denote, but what they connote. The only names which connote nothing are proper names."

Jevon's theory apparently refutes Mill's, as is seen from :—

' The connotation of a name is confused with the etymological meaning or the circumstances, which caused it to be fixed to a thing ——No one who uses the name of England, knows what it denotes, can be ignorant of the peculiar qualities and circumstances of the country, and those for the connotation of the term.' For the knowledge of the condition or meaning of a proper name, we need have recourse to philology and psychology.

As to the relation of the connotation and denotation

of a term, it is enough for the student to bear in mind that, addition to the connotation accompanies subtraction from its denotation.

Proposition and its different constituents.

Copula can have five different functions:— (1) Substitution, (2) Linking medium of independent sentences, (3) Commodious contrivance to connote the subject destitute of time, (4) Past universality and condition, and (5) Existence.

From the above enumeration of the functions or uses of Copula, it is evident that, Mill takes not only the present, but in fact the three principal tenses without the negative particle joined. But there are logicians, such as, Mansel, Fowler, and Hamilton, who have taken *copula* to convey the present only, with or without the negative particle. But dismissing ' not' gives rise to the multiplicity of meanings as shown by Mill, simply for the limitation of the meaning of the same. Therefore, we should take the negative particle as inseparable from, or a part of, the copula.

About the truth and falsity of the one and the other of disjunctive proposition, there is a great difference of opinion among logicians. Mill, Whatley, and Mansel entertain a one-side view of, the relation between the alternatives of a disjunctive proposition; they say that, the falsity of one alter-

native member, involves the truth of the other,
but not *vice-versa*. Hamilton, Boole, Ueberweg
and Fowler, on the other hand, hold that, not only
the truth of the cue proves the falsity of the other
but the falsity of the other proves the truth of
the first alternative. Modality of a proposition is
merely a means for an expression of the degrees
of conviction. ———

Illustration of the meanings of the four
propositions by diagrams.

All Universal affirmative and negative proposi-
tions in all the different cases can be represented
respectively in the diagrams No. 1 and No. 2 below:—

The substantive view in which the attribute
belonging to the subject is a part of the non-denotat-
ive Predicate, comes under Dia. 1 where ·A is
contained in ·B. The denotative, the connotat-
ive, and the denotative-connotative can also be
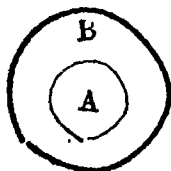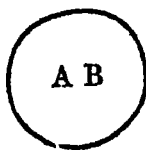
Dia. 1.   Dia. 2.   Dia. 3.

Dia. 4.   Dia. 5.

illustrated similarly but ·A and ·B both exclud-
ing or being outside each other, is an illustra-
tion of E., a universal negative in all its
different cases, and the one case only of a par-
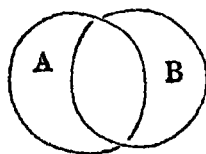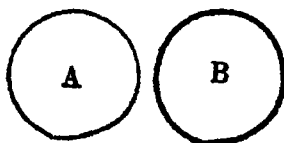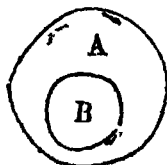ticular negative in which the subject and predicate
both exclude each other.   Dia. 2 shows the relation
between the two existences of an A., when they are
of equal extent; this relation between the subject
and the predicate being called equational.   The
student can have a clearer impression of these rela-
tions, when the symbolic representation is made
concrete.   Take the following examples:—

   1.   All men are rational beings.

   2.   No irrational animals are beings.

   3.   Some men are rational animals.

   4.   Some men are not poets.

   The first and the second diagrams represent the
meanings of A.   When the predicate in denotation
contains the subject and in connotation is contained
by the subject, as, in ' All men are living beings,'
the meaning of the proposition is represented by
the first diagram.   But when the subject and the
predicate are co-extensive, as, in ' All men are ra-
tional animals', the meaning of the proposition is
represented by the 2nd diagram.   The 3rd diagram
represents the meanings of I.   When neither the
predicate nor the subject contains the other entirely
in denotation or connotation, as in ' Some men are

philosophers,' the meaning of the proposition is represented by the 3rd diagram. When no part of the subject contains or is contained by any part of the predicate, as in all E propositions, the meaning is represented by the 4th diagram. When some part of the predicate does not contain or is not contained by the subject, as, in ' Some men are not poets,' the meaning can be represented both by the 3rd and the 5th diagrams.

The meanings of A, E, I, & O can be represented from the stand points of all the views of the theory predication ; i. e. from the point of denotation, from the point of connotation, and from the point of denotation and connotation both of the subject and the predicate.

Determining the meanings of propositions and inferring conclusions by the syllogistic process can be very easily done by students by means of diagrams. There can be two diagrams for representing the meanings of A, one for that of B, four for those of I, and three for those of O. All of these when combined present a series of five, as shown here.

There is some difference of opinion as to the predicables. Aristotle's classification is confined to four only. Before giving a few instances of such, Mansel's view of a concept, a judgment and a subject, is thought useful to be given here,

as they may be important to the student. Mansel
says:— " A concept is a collection of attributes
united by a sign, and representing a possible
object of intuition."

" A judgment is a combination of concepts,
related to one or more objects of possible intuition."

" The subjects of all logical judgments are to be
distinguished from psychological, such as, the
spontaneous judgment of perceptive and imaginat-
ive faculties, or concepts."

Sir W. Hamilton and his advocate Thomson
entertain the theory of the quantification of the
predicate. Hamilton's eight forms of propositions
accordingly are :—

> All A is some B (A).
> All A is All B (U).
> No A is any B (E).
> No A is some B (N).
> Some A is some B (I).
> Some A is all B (Y).
> Some A is not any B (O).
> Some A is not some B.

Mill disproves the theory by saying that predi-
cate is not thought of in its extension, but in its
comprehension; that all the logical propositions
should have an ordinary form of statement; and
that logic should begin with the simplest and most

ordinary forms of judgments. The theory of the quantification of predicate going against all of these criteria should be looked upon as not important for logical purposes.

In his 'Lectures,' Hamilton has taken precaution against the attacks of his opponents by saying,— " The non-quantification of the predicate in thought is given up by logicians themselves, but in only certain cases, where they were forced to admit, and to the amount which they could not possibly deny. The Predicate, they confess, is quantified by particularity in the affirmative, and by universality in the negative propositions; but why the quantification, and formal quantification should thus be restricted in thought, they furnish us with no valid reason." For instance in the examples " God is good," " Virtue is only nobility," we have not only the comprehension, but extension also in the mind ; since we mean God is all good, and all that is good is virtue.

On Syllogism.

Whatley's Canons for pure categorical syllogism :— (1) " If two terms agree with one and the same third, they agree with each other"; (2) " If one term agrees with another and disagrees with one and the same third, these two disagree with each other."

Hamilton's Canons for extensive Categorical syllogism,—(1) " It must have three and only three terms constituting three and only three propositions (2) of the premises, the sumption or major premiss must in quantity be definite, that is, universal, and the sub-sumption or minor premiss in quality affirmative; (3) the conclusion must correspond in quantity with the sub-sumption, and in quality with the sumption." His Canons for the (1) figured and (2) unfigured syllogism, into which he divides the categorical syllogisms :—

(1). The terms compared here are either both the subject, or both the Predicate of in the same proposition. " In so far as two notions (notions, or individuals,) either both agree, or one agreeing the other does not, with a common third notion ; in so far, these two notions do, or do not agree with each other."

(2). The terms compared here are severally the containing and the contained ; and in relation to each other, the Subject and the Predicate with reference to Extension and Intension. The canon for such is "What worse relation between the Subject and the Predicate subsists between either of the two terms and a common third, with which one at least, is positively related, that relation subsists between the two terms themselves."

Thomson's Canons :—

For the first figure,—"The agreement or disagreement of a subject and predicate is ascertained by a third conception, predicate to the former and subject to the latter ; inasmuch as this wholly or by the same part agrees with both, or with one only, or of conceptions to be compared."

For the second figure,—"The agreement of two conceptions, ascertained by a third conception which stands as predicate to both ; inasmuch as this, wholly or by the same part agrees with both or with one only of the conceptions to be compared."

For the third figure,—" The agreement of two conceptions is ascertained by a third conception, which stands as subject to both ; inasmuch as this wholly or by the same part agrees with both, or with one only, of the conceptions, to be compared."

Mill's Canons of Ratiocination or syllogism :—

(1). "A thing which co-exists with another thing, which other co-exists with a third thing, also co-exists with the third thing."

(2). "A thing which co-exists with another thing, with which other a third thing does not co-exist, is not co-existent with that third thing."

His canons for determining the meanings of propositions :—

(1). "Whatever has any mark, has that which it is a mark of."

(2). "Whatever is a mark of any mark is a mark of that which the last is a mark of."

The first refers to cases where the major premiss has for its subject a proper name, and the second to cases, where the major and minor both are universal propositions.

Lambert's Canons ;—

For the perfect figure he has Aristotle's Dictum.

For the second figure,—"If one term be contained in, and another excluded from a third term, they are mutually excluded."

For the third figure ;—"Two terms which contain a common part, partly agree, or if one term contains a part which the other does not, they partly differ."

For the fourth figure ;—" If no M is B, no B is this or that M ; if C is not this or that B, there are' B's which are or are not C." The second, he names' *Dictum de Diverso,* the third, *Dictum de Examplo,* the fourth, *Dictum de Reciproco.*

Martineau in his essays gives a canon for the' affirmative relation of the first figure, and the dictum in a modified form. His dictum for the second and'

third figure will prove interesting to the student and they are given in order below ;—

(1). "If the attribute be present with one nature and absent from another, neither of these can be an attribute of the other."

(2). "Where two attributes are co-present in the same sphere, each is an attribute of something having the other."

Aristotle's Dictum, in fact, explains the relation of a container to the contained ; and so it is clear at once from what is given by Whatley.

In Constructive Hypothetical-Categorical Syllogisms, the process of drawing inference is called *modus ponendo ponens.* In Destructive Hypothecal-Categorical Syllogisms the mode of drawing inference is called *modus tollendo tollens.*

What Ueberweg says respecting the Dilemma, is very important for the student to note.

" The Dilemma" he says " in the stricter sense, an inference of the second figure, with a Hypothetical Disjunctive premiss and with a remotive premiss. "

" In the wider sense of the term, inferences- with a Categorico-disjunctive premiss, and inferences in the first figure with a disjuntive and a copulative or remotive premiss, are also attributed to it. The

like holds good of Trilemma, Tetralemma and Polylemma. "

Of the Syllogistic process, Mill says, " All is from particular to particular. General propositions are merely registers of such inferences made, and short formulas for making the more. " The conclusion is not immediately deducible from the major, but is to be according to it. Thus he does not admit that this is the process by which we reason. It is but a way of systematizing our reasonings. An induction, from particulars to general, according to him is not the way by which " we must reason, " but the way by which " we may reason. " The most ordinary process of reasoning, he says, consists in the following :—

Certain individuals have a given attribute ; an individual or individuals resemble the former in certain other attributes; therefore they resemble also in the given attribute. The process of Deductive Reasoning or Syllogism is therefore a means to make the general proposition explicit. Speaking of the justifiability of particular conclusion from general premiss, he says :—" No reasoning from generals to particulars can prove anything ; since from a general principle we cannot infer any particulars but those which the principle itself assumes as known." The Syllogism, as a mode of probation, involves, according to Mr. Mill, the

fallacy of *Petitio Principii.* The value of syllogism lies inasmuch as it means to test the validity of the process of reasoning. There are two classes of Logicians, one advocating, another strongly oppos-ing Mill's theory of the functions of syllogism. Of the former class are Bain, Bailey, Dr. Whewell, Sir J. Herschel, and others ; and of the latter are Martineau, DeMorgan, Mausel and others. From the little that has been given of Mill, the stu-dent is apt to think that Mill, to a great extent, withdraws syllogism from the process of reasoning. To avoid su   mistakes, the province of psycho-logy is to be distinguished from that of Logic. We may not ordinarily reason according to the process ; yet, because it is the test, it is all-import-ant in the latter science.

James Martineau shows conclusively that Mill's statement, all syllogisms involve *petitio principii,* is simply impossible, and destructive of all sciences. He admits that one sufficiently intelligent may see what conclusion must necessarily follow— from the major premiss assumed; but for that it cannot be reasonably held that, it would not involve the fallacy; for the conclusion is not drawn from either of the premises but from both, conjoint-ly, and that the drawing of a conclusion would have been unnecessary, had they been present in the mind as the premises.

DeMorgan supports Dr. Martineau's view on the ground that there would not have been any need of a minor premiss, had it been for the sufficiency of the minor, to justify the conclusion. From Martineau's opinion, it would have been possible for the mind to arrive at the conclusion in all cases, had it been for its omniscience.

The conclusions of Deductive Reasoning are entirely of an hypothetical character, since here a reasoner is not concerned with the truth or falsity of the premises, but only with the justifiability of the conclusion.

Whatley teaches the necessity of Reduction of the 2nd, 3rd, and 4th figure to the first, and the all-importance of the *dictum de omni et nello*, and asserts that all pure categorical syllogisms are grounded on (1) "If two terms agree with one and the same third, they agree with each other ; (2) if one term agrees with another, it disagrees with one and the same third, these two agree with each other." Dilemma he defines to be "a conditional syllogism with several antecedents in the major and a disjunctive minor."

The student has been shown how Thomson discards the fourth figure and accepts the first three. He defines Dilemma as "a syllogism with a conditional premiss, in which either of the antecedents or consequents is a disjunctive."

Mill's—

From Lambert's canons for the 2nd, 3rd, and 4th figure, it ought to be clear that he does admit the importance of reduction of the imperfect figures to the first, *i.e.*, the perfect one.

Mixed syllogisms are mediate inferences, and not immediate, can be evident at once from the fact of their being composed of others of a different nature. Pure Categoricals and Pure Hypotheticals can have Immedeate Inferences. Although coming to an undisputed agreement as to the foundation of all Inductive Reasoning ; viz., (1) the Uniformity in the laws of nature and (2) the necessity of causation, logicians differ in enumerating the conditions of causation. These conditions can be enumerated as follows :—

1. Every cause is invariable, since it is to be sought and found among the constituents of its effect.

2. Every cause must, under all circumstances, have the same effect.

3. If effect can be expected from a cause of which something can be left out as not influencing it, that something is to be considered as cause, and similarly of effect in relation to cause.

4. Bain says, 'an antecedent and a consequent rising and falling together in *numerical concomittance* are to be held as cause and effect.'

5. ' If two or more instances of a phenomenon under investigation have only one circumstance in common, that circumstance is the cause (or the effect) of the phenomenon.'

6. If in a case in which a phenomenon occurs, or one in which it does not occur, have every circumstance in common except one, that one occurring only in the first, the circumstance present in the first and absent in the second, is the cause, or a necessary part of the cause of the phenomenon.

No reasoning can be possible without taking for granted the truth of the uniformity of the laws of nature. It involves the fundamental Principle of Identity.

QUESTIONS.

I. Define Logic from the various points of view, advocated by the different classes of philosophers.

II. How does Ueberweg define Logic ? Is the definition defective ? If so, point out the defects ; and give a correct definition.

(b) How do Mill and Whatley define Logic ?

III. What apparent contradiction Hamilton's definition of Logic seems to involve, when compared with Whatley's definition ?

IV. How do British logicians differ from the logicians in general in Europe in the subject-matter of the science.

V. What difference do you mark in the definition of a 'concept' as given by the conceptualists and the realists ? Explain by taking instances from Hamilton, Mill and Spencer.

VI. To what particular classes do the following logicians belong ; viz, Hamilton, Mill, Spencer, Thomson, Whatley, Fowler, Jevons, Ueberweg ?

VII. What does Herbert Spencer mean by Non-Ego Give the subject-matter of his definition of Logic.

VIII. Distinguish between Real Logic and Formal Logic, and a Real truth and a Formal truth.

IX. What fourth division do some of the Logicians add to the three general divisions of Logic. Wherein does the importance of this additional division lie?

X. Lay down the fundamental principles of thought, or axioms and postulates of logic.

(b) Are there cases in which the principles of contradiction, and of the Excluded Middle admit of exceptions ? If there are, show what they are.

XI. Name the two Logicians, who have enunciated the Fundamental Principle of consistency. Enumerate the seven Fundamental Principles of Deductive Logic. Say which of these are the chief ones. Can you show how to deduce the Fundamental Principle of contradiction, and that of the Excluded Middle from the Fundamental Principle of Identity ?

XII. In addition to the four Fundamental Principles of Deductive Logic, leaving aside, of course, Aristotle's Dictum, the General rules of syllogism, and Mathematical axioms, Ueberweg adds another, viz, the Axiom or Principle of sufficient Reason to the rest ; and how is it that even after this addition he counts them four in all ?

XIII. Explain what you understand by the following :— (a) a priori, (b) a posteriori and (c) a fortiori.

10. How do the British Logicians differ from the other Logicians ?

* XIV. Distinguish the following terms—Connotation, denotation; quantity, quality ; definition, description ; mediate and immediate inferences; distributed and undistributed terms.

XV. Explain clearly the difference between attributives and abstract terms ; and state to which class do the following terms belong :—Circle, figure, honesty, gold, virtue subject, possession ; Presidency College students, the candidates for this examination.

XVI. Point out the logical characters of the following terms :—

Bismarck, monarch, triangle, needlepoint, representation, planetary system, the Senate of the University of Lahore, the present Principal of the Lahore Government College, a book of reference, the defeat of the Spanish Armeda, a mute in glorious Milton, an idiot boy, School Board, weights, viberation, science, atmosphere, alcohol, axiom, socialism' veracity, constant, beautiful, and essential.

(b) Ascertain and explain the ambiguities, which affect any of the following terms :—

Organ, ear, rock, corn, march, and mean.

XVII. Explain accurately and criticise " The denotation and connotation of a term vary inversely."

XVIII. Do names and terms vary from each other in their functions ?   What is a concept ? and   what is the relation between a concept and a term ?   Give a methodical classification of terms.

XIX. To what conditions   must definitions always conform in order to be valid ?

(b) Test the following definitions.—

　　i. Food is that which is swallowed.

　　ii. Flower is that part of a plant which is fragrant.

　　iii Logic is a science of human knowledge.

　　iv Tin is a metal lighter than gold.

    v Diamond is a kind of carbon.

    vi Vice is opposite of virtue.

    vii Cheese is a caseous preparation of milk.

    viii Rust is the red dequamation of old iron.

    ix A man is a knowing animal.

    x Knowledge is power.

    (*c*) Define the following terms :—College University, Municipality, a Board of Examiners, gravitation, consistency, library, franchise, imagination, honesty, communion, honor, club and dictionary.

XX Characterise the following propositions :—

    i A horse, a horse, a kingdom for a horse.

    ii Virtue consists neither in excess nor defect of action, but in a certain mean degree.

    iii The glories of our blood and state are shadows, not substantial things.

    iv Private property should be respected in war.

    v No woman should be admitted to the franchise.

    vi Capital punishment ought to be abolished.

    vii Written examinations are not a safe test of merit.

    viii Many men are not so clever.

    ix Most people are wanting in faith.

Give the logical character of each of the propositions:—

    (*a*). Only the brave deserve the fair.

    (*b*). I shall not all die.

    (*c*). No one is always happy.

    (*d*). One kind of metal at least is liquid.

    (*e*). Not many of the metals are brittle.

    XXI. Define Division ; state the rules of Logical Division, and examine by their aid the correctness of the following:—

    (*a*). Mind into a state of knowing, states of feeling, and states of willing.

(ō). Man into body and mind (c) Man into vertebrate
and invertebrate." (d) the inhabitants of a town into men,
women, artizans, professional men, lawyers, carpenters, the
magistrate, and the poor. (e). Nations into progressive
and stationary.

* XXII. Show by example the difference between gene-
ric and specific property*; inseparable and separable acci-
dens. Refer the following predicates of 'gold' to their proper
heads.

(a). Gold is a metal (b) Gold is heavier than iron
(c) Gold is found in Australia (d) Gold is yellow (e) Gold is
in Latin, *aurum.*

XXIII What is a theory ? What is a predication ? What
do you mean by the Theory of Predication ? Give Martineau,
Hamilton, and Ueberweg's views on the theory of predication
and state what remarks can be reasonably made against the
attributive theory.

° XXIV. (i) Explain permutation ; supply the process to
the following examples :—

(a). No one can hope for success without industry.

(b) Only a man of genius can hope for success without
industry.

(c) All the greatest nations, that the world has ever seen,
have been disinclined to luxury.

(d) Upright men are indifferent to flattery.

XXV Draw conclusions by various modes of immediate
inference from 'All intelligent men have a sense of economy.'

 XXVI Define mood, figure ; show that in the 3rd
figure, the minor premiss must be affirmative, and that
in the 4th, neither premiss can be O.

XXVII. Two premises and a conclusion being given, show how to determine.—

(a). The major, and middle terms ; (b) the order of the premises ; (c) the figure ; (d) the mood , the validity of syllogism. Apply your method to the following examples :—

No untruthful man is fit for a responsible position.

Some men of strong will have no regard for truth ; Therefore some of those, who are for a responsible position, are not men of strong will.

XXVIII. Exaplain and exemplify the formation of terms, and thence deduce the relation between the extensive and intensive capacity of common terms.

XXIX. What are the 'heads of predicables' ? In what propositions may the predicate (a) a species, (b) a property (c) an inseparable accident, (d) a separable accident be used ? In each of these instances, state what kinds of terms may appear as the subject and the predicate respectively. State precisely Mill's theory of Predication.

* XXX. Explain the ambiguity of the term Inference. Define Immedeate Inference, and explain " Conversion by negation." Give the converse of (a) Great is Diana of the Ephesians, (b) All Europeans are Germans, (c) Virtue is a condition of happiness. Are hypothetical reasoning forms of Immedeate inference ? Give reasons for your answer.

* XXXI. Give the possible combinations of A, E, I, O, to determine which of all the possible combinations of them as premises lead to valid conclusions. State fully each step in the process.

* XXXII. Give the genus or species, differentia, a property, or an accidens of each of the following,—Triangle, plant, Register of the University of Calcutta. Beast of burden.

* XXXIII. What different opinions have been held regarding the modality of propositions ? Is the proposition "Scott generally sat in the chair," equivalent to " Scott was the general sitter in the chair " ?

° XXXIV. How may a conclusion be drawn from probable premises ?

* XXXV. Define the following terms :—Analytical and Synthetical judgments ; Modality ; Fundamental laws of thought ; Enthymeme ; Analogy.

° XXXVI Prove the fourth figure ; reduce any one of its moods.

* XXXVII Discuss the statement that " every syllogism is a Petitio Principii."

° XXXVIII Distinguish between particular premiss and probable premises.

(i) Explain the conditions of a legitimate inference from two particular premises, and specify the character of the inference.

(ii) Explain the inference which may be drawn from two probable premises.

* XXXIX (i) Given either a particular major, or a Particular minor in the fourth figure, to find in each case the mood.

(ii) Show that if the minor premiss be negative, the middle term is but once universal.

* XL (i) Prove the special rules of the Third Figure ; and (ii) that, if one premiss of a syllogism be particular, the conclusion must be particular.

+ XLI What is the use of Reduction. Exemplify both kinds by reducing the two following syllogisms :—

(a). Some magistrates are not strong men, but all magistrates have to preserve peace and order ; therefore some have to preserve peace and order who are not strong men

(b) All works of history must contain more or less of error, though some of them are written with great ability ; therefore some works written with great ability are not altogether trustworthy.

XLII Explain what you mean by *Reductio per deductionem an. impossibile.* Reduce Baroko and Bokardo by this method.

XLIII + Describe the Aristotellian or progressive and Goclenian or repressive forms of Sorites, and prove the rules which govern each.

XLIV † Give a reasoned estimate of the value of Hamilton's doctrines ;

(a) Of the quantification of predicate.

(b) Of the forms of hypothetical and disjunctive reasonings, being forms of immedeate inference.

† XLV. Compare the views of the province of Logic given by (a) Sir W. Hamilton and (b) Mr. J. S. Mill.

° XLVI. Define the Dilemma, and mention the different forms it assumes.

Examine ;—If the books in the Alexandrian Library are in conformity with the Koran, there is no need of them ;

if they are never adverse to the Koran, they should be destroyed.

* XLVII. State and explain the various forms of complex syllogism. Determine—

(a) to what class each of the following syllogisms belong :—

(b) its validity.

(i) If schoolmasters can claim exemption from poor rates, it must be either by statute or by the common law ; but neither does the statute exempt them, nor the common law apply ; therefore, they can claim no such exemption.

(ii) If Lord Bacon is right, it is improper to stock a new colony with the refuse of the jails ; but this allows not to be improper of our late method of colonizing New South Wales as a wise one , if this be wise ; therefore Lord Bacon is not right.

(iii). If the studies prescribed by the Calcutta University tend to advance a man in life, they are useful ; if they tend to increase national and private wealth, they are useful; but the prescribed course of studies has neither the one tendency nor the other ; therefore they are useless.

* XLVIII Write out all the forms of *conjunctive* and *disjunctive* syllogism. To what does Hamilton reduce these ? What is Mill's view of the disjunctive proposition ?

* XLIX Lay down the laws for a logical division. Exemplify the division and sub-division of a common term. State the logical names given to terms to mark their several positions and sub-divisions.

L. Prove the following rules:—

If one premiss of a syllogism be particular, the conclusion must be particular.

In the first figure the major premiss must be universal.

In the third figure the conclusion must be particular.

LI. What is an enthymeme? Has the word undergone changes in the meaning of it?

(b) Point out the premises suppressed in the following:—

i Blessed are the meek; for they shall inherit the earth.

ii The science of Logic is very useful, it enables us to detect our adversary's fallacies.

iii He must be at New York, for he is not at London.

iv I shall not determine any opinions from books, for I have none.

v Whosoever loveth wine shall not be trusted of any man; for he cannot be trusted.

vi Whales are not true fishes, for they respire air; moreover they suckle their young.

vii The Queen is at Windsor, for the Royal standard is flying.

viii The nation has a right to good government; therefore, it may rebel against bad government.

LII. Examine the following arguments :—

(1) None but Whites are civilized,

Hindus are not whites ;

Therefore, they are not civilized.

(2) If virtue is voluntary, vice is voluntary ;

But vice is voluntary ;

Therefore, so is virtue.

(3) All that glitters is not gold ;

But my chain glitters ;

Therefore, it is not gold.

(4) All material things gravitate, air gravitates ; air is therefore material.

(5) Philosophers are apt to undervalue common sense ; Reid is a philosopher ; therefore Reid is apt to undervalue common sense.

(6) My opinions must be true, for none but a prejudiced and uncandid person like yourself would wish to gainsay them.

(7) The soul always thinks, inasmuch as to think is its nature as a cognative substance.

(8) I can afford to buy these books ; I can afford to buy these pictures ; I can afford to buy these statuettes. The books, the pictures, and the statuettes are all that I at present wish to purchase ; I can, therefore, buy everything that I want to buy.

(9) All animals are either birds, beasts or fishes. A bat is not a bird, because it brings forth its young alive ; it is not a beast, because it flies in the air, and it is not a fish ; therefore, a bat is not an animal.

(10) " It is absurd for you, for many years to advocate the consistent liberties of the people, to turn round now and to

profess this extraordinary affection for despotic government.
Your ancestors, if they were alive, would blush for such a
degenerate descendant."

(11) " My client is charged with murder. The evidence
against him consists of a number of circumstances so trivial
that you examine each one separately, you must reject it
as furnishing no conclusive proof of guilt ; I call upon you,
therefore, to acquit the prisoner."

(12) If I were in your place, I should punish this man
severely ; but I am not.

(13) India comprehends Bengal ; Bengal does not
comprehend Bombay; therefore, India does not comprehend
Bombay,

(14) Gold is heavier than lead, and is heavier than
silver ; silver is heavier than tin ; therefore gold is heavier
than tin.

(15) Most men have brothers ; most men have sisters.
Is there any conclusion deducible, and why ?

(16) " We can have no conception of anything but what
resembles some sensation or idea of our minds ; but the
sensation or idea of our minds can resemble nothing but the
sensations and ideas of our minds, therefore the conclusion
is evident. What conclusion ?"

(17) " Predestination makes men immoral ; for if man
be predestined to salvation, his exertion must be useful ;
predestined to damnation, it must be unavailing."

(18) My hand touches the pen, the pen touches the paper ;
therefore, my hand touches the paper.

(19) The Germans are a literary nation; therefore A B, who is a German, is a literary man.

(20) Alexander is the son of Philip; therefore Philip is the father of Alexander.

(21) He must be a Mahomedan; for all Mahomedans hold this opinion.

(22) Mercy but murders, pardoning those that kill.

(23) All law is an abridgment of liberty, and consequently of happiness.

(24) A student of history is compelled to admit the truth of the law of progress, for he finds that the society never stood still.

(25) Every hen comes from an egg; every egg comes from a hen; therefore, every egg comes from an egg.

(26) Treason doth never prosper: what's the reason?

(27) No beast so fierce but shows some touch of pity. But I know none, therefore I am no beast.

(28) He who calls you a man speaks truly; he who calls you a fool calls you a man; therefore he who calls you a fool speaks truly.

(29) Large colonies are detrimental to the power of a State as overgrown limbs to the vigour of the human body.

(30) If I were in your place, I should punish this man severely, but I am not.

(31) Haste makes waste, waste makes want ; therefore a man never loses by delay.

(32) All men are responsible ; all men will be rewarded or punished ; therefore all men will be rewarded or punished.

(33) The stoics teach that we should live according to nature, in obedience to conscience, with pious resignation to the divine will ; Bishop Butler teaches the same lesson ; therefore Bishop Butler is a stoic.

(34) I remember what I have read ; I have read every line of Milton ; therefore, I remember every line of Milton.

(35) The missing watch was found under your pillow ; that is a presumption against you ; therefore I shall presume that you are a thief.

(36) If you eat too much, you suffer from indigestion ; you do suffer from indigestion ; therefore, you eat too much.

(37) If the student has fever, he is unfit to attend the examination ; but he is unfit to attend ; therefore he has fever.

(38) If it be fated that you recover from your present disease, you will recover whether you call a Doctor or not ; again if it be fated that you do not recover from your present disease, you will not recover whether you call in a Doctor or not ; but one or other of these contradictories is fated, therefore it can be of no service to call in a doctor.

(39) Suppose Achilles to move ten times as fast as the Tortoise, but the Tortoise to have the start of Achilles, say, by one tenth the distance to be traversed when Achilles has arrived at a point from which the Tortoise

started, the Tortoise will still be one-third part of the whole distance in advance of him, when Achilles has reached the point will still be one thousandth part of the whole distance in advance of him; and so on. Thus Achilles will never be able to pass.

(Fallacy of Achilles and Tortoise).

(40) The scarcity of a dear year, by diminishing the demand of labor, tends to lower its price, as the high price of provision tends to raise it. The plenty of a cheap year, on the contrary, by increasing the demand, tends to raise the price of labor, as the cheapness of provisions tends to lower it. In the ordinary variations of the price of pro-visions, those two opposite causes seem to counterbalance one another; which is probably in part the reason why the wages of labor are everywhere so much more steady and permanent than price of provisions.

Adam Smith, *Wealth of Nations.*

(41) We are not inclined to ascribe much practical value to that analysis of the inductive method which Bacon has given in the second book of the *Novum Organum.* It is indeed an elaborate and correct analysis. But it is an analysis of that, which we are all doing from morning to night, and which we continue to do even in our dreams.

Macauly, *Essay on Bacon.*

(42) A system of government, which extends to those actions that are performed secretly, must be one which refers to a regular divine providence in this life, or to the reward or punishment of another world. Every perfect system of government must extend to those actions which are performed secretly; no system of government,

therefore, can be perfect, which refers either to a regular divine providence in this life or to the rewards and punishment of another world.

<div align="right">Warburton's *Divine Legation.*</div>

(43) The connexion of soul and body cannot be comprehended or explained ; but it must be believed ; therefore something must be believed which cannot be comprehended or explained.

<div align="right">Whatley.</div>

(44) Meat and drink are necessaries of life : the revenues of Vitellius are spent on meat and drink : therefore the revenues of Vitellius were spent on necessaries of life.

<div align="right">Whatley.</div>

(45) Nothing is heavier than platina; feathers are heavier than nothing ; therefore feathers are heavier than Platina.

<div align="right">Whatley.</div>

(46) I cannot accept your opinion as true, for it seems to me that its recongretion by the masses would be attended with the most injurious consequences to society.

(47) Logic is indeed worthy of being cultivated, if Aristot'e is to be regarded as infelible, but he is not : Logic therefore is not worthy of being cultivated.

<div align="right">Whatley.</div>

(48) Warm countries alone produce wines; Spain is a warm country; therefore, Spain produces wine.

<div align="right">Whatley.</div>

(49) Of two evils the less is to be preferred: occasional turbulence being a less evil than rigid desposition is to be preferred to it.

(50) I am a Jew. Hath not a J w eyes ? Hath not a Jew hands, organs, dimensions, senses, affections, passions,

fed with the same food, hurt with the same weapons, subject
to the same diseases, healed by the same means, warmed and
cooled by the same winter and summer, as a Christian is ?
If you prick us, do we not bleed? If you poison us, do we not
die ? and if you wrong us, shall we not revenge ? If we are
like you in the rest, we will resemble you in that.

                                    Shakespeare.

LIII.   Which of the Logicians do not recognize the necessity of reduction ? Which of them discard the fourth figure?
Give the canons of syllogism for the different figures as
established by Thomson and Lambert.

LIV. What are mixed syllogism ? Is there any distinction
between a syllogism and a Dilemma ?

LV.   State the rules of valid conversion.   Point out the
mistakes often made in contrapositive conversion.

LVI. Classify fallacies. Test the following arguments
stating each in complete logical form :—

(a) A's advice ought to be rejected, because his character
is not good.

(b). I cannot assist you, because I do not deem it right
to encourage beggars.

(c). Every man has a right to inculcate his own opinions,
therefore a magistrate is justified in using his power to
propagate his religious views.

(d). The chance you advise cannot be for our good,
because it is contrary to the institution of our ancestors.

(e) A successful teacher must either be very industrious
or very talented ; Gibbon was very industrious, therefore he
was not very talented.

45. Illustrate how the connotation and denotation of a
term vary inversely.

LVII. {Probable mediate reasoning is generally taken as *formal* or *experimental*. How do you distinguish the latter from the former? Lay down rules for both the processes of reasoning. •

LVIII. Give the canons of syllogism as laid down by Thomson, Lambert, and Mill. Show whether the canons of any of the logicians differ in any way from those of another.

LIX. Does James Martineau defend syllogism against the attack of Mill? If he does so, show how he does.

LX. What does Hamilton mean by figured and unfigured syllogism? Explain the terms with examples.

THE END.

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